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Table of Contents

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ORIGINAL ARTICLES— PAGE.
"Observations on Certain Aspects of the Cyclic Vomiting Syndrome", by LORIMER DODS, M.B., Ch.M. .. 231
"Vitamin *C* in the Australian Fauna", by GEOFFREY BOURNE, D.Sc. .. 260

REPORTS OF CASES—
"A Case of Varicose Coronary Sinus", by KEMPSON MADDOX, M.D., M.R.C.P. .. 261

REVIEWS—
A Handbook of Gynæcology .. 261
Suicide .. 262
Differential Diagnosis .. 262
Talmudic Medicine .. 262

LEADING ARTICLES—
Gad-Flies .. 263

CURRENT COMMENT—
Amœbic Dysentery .. 264
The Mechanism of Cavity Formation in the Lung 265
The Printing of the Journal .. 265

ABSTRACTS FROM CURRENT MEDICAL LITERATURE—
Pædiatrics .. 266
Orthopædic Surgery .. 267

BRITISH MEDICAL ASSOCIATION NEWS— PAGE.
Scientific .. 268
Nominations and Elections .. 272

CORRESPONDENCE—
The Hereditary Factor in Mental Disorders .. 272
Schilder's Disease .. 272
Whooping Cough and Vaccine Treatment .. 273

PROCEEDINGS OF THE AUSTRALIAN MEDICAL BOARDS—
New South Wales .. 273

UNIVERSITY INTELLIGENCE—
The University of Sydney .. 273

OBITUARY—
Donald Tregonning .. 273
Samuel Hardy Halahan .. 273
George Bill .. 273

THE STAWELL MEMORIAL FUND .. 273

DIARY FOR THE MONTH .. 274

MEDICAL APPOINTMENTS .. 274

MEDICAL APPOINTMENTS VACANT, ETC. .. 274

MEDICAL APPOINTMENTS: IMPORTANT NOTICE 274

EDITORIAL NOTICES .. 274

OBSERVATIONS ON CERTAIN ASPECTS OF THE CYCLIC VOMITING SYNDROME.

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MY interest in the problem of the so-called cyclic vomiting attack of childhood is largely the result of the difficulties which I have experienced in the course of general practice in attempting to treat susceptible children, their attacks and their parents. In many text books the problems of the prevention and treatment of these attacks are cheerfully and confidently dismissed with a few optimistic statements about the careful restriction of fat and the administration of extra carbohydrate. My original confident acceptance of the adequacy of this form of treatment was severely shaken when I discovered that many of these children showed little, if any, response to such a diet.

The following work was undertaken in the hope of elucidating some aspects of cyclic vomiting and of investigating the relationship, if any, between this syndrome and the ketosis of childhood. With the exception of the biochemical investigations, the greater part of this study is based on the clinical observation, over an average period of more than two years, of a group of eighteen "susceptible" children (collected from out-patient and private practice).

KETOSIS AND KETONURIA.

Ketosis may be defined as an abnormal accumulation of "ketone bodies" (acetone, aceto-acetic and the closely related β-hydroxybutyric acid, which, however, is not a ketone) in the body, and is usually recognized by the finding of more than the normal amount of one of these substances in the urine. Much confusion as to the exact significance of the term ketosis has resulted from the occasional unfortunate use of this word to signify that type of

acidosis which is assumed to have resulted from an accumulation of ketone bodies. As a result, it is not unusual for a state of ketosis to be referred to as an acidosis, although the presence of an abnormal accumulation of ketone bodies does not necessarily imply any change in the acid-base balance. In the vast majority of instances of ketosis there is no change in the acid-base balance, and the word acidosis should never be applied to a state of ketosis unless there is some evidence of an accompanying disturbance of this acid-base balance.

The most satisfactory and commonly accepted tests for ketone bodies in the urine are the sodium nitroprusside test of Rothera and Gerhardt's ferric chloride test. A certain amount of confusion seems to exist about the interpretation and significance of these tests, and this is aggravated by the loose methods of recording results occasionally encountered in case reports and text books. This confusion seems sufficiently great to excuse a brief discussion of the subject.

In the normal course of oxidation of fatty acids in the body, aceto-acetic acid is formed as an intermediate product and is then oxidized to carbon dioxide and water. Under certain conditions aceto-acetic acid accumulates in the organism and is excreted in the urine. Some of the aceto-acetic acid may be reduced to β-hydroxybutyric acid, and some may decompose to acetone and carbon dioxide.

Aceto-acetic acid decomposes so readily, with the formation of acetone, that acetone and aceto-acetic acid are usually both present in the urine of ketosis, and both produce a positive result to the sodium nitroprusside test. A positive response to Gerhardt's test is never given by acetone alone, and only by large amounts of aceto-acetic acid, in which case the result of Rothera's test is also strongly positive. As small amounts of aceto-acetic acid do not produce a reaction with Gerhardt's test, the result of this test, when positive, may be regarded as evidence of a comparatively severe degree of ketonuria.

Apparently there is no simple test for β-hydroxybutyric acid.

A positive response to the sodium nitroprusside and a failure of response to the ferric chloride test are often found reported as "acetone present, but aceto-acetic acid absent". As Lawrence[1] and Graham[2] have pointed out, this is definitely inaccurate and implies a qualitative distinction which Rothera's test does not afford. This error probably arose through Rothera's early observation[3] that a response to his modification of the sodium nitroprusside test was given by acetone but not by aceto-acetic acid, whereas a response to the ferric chloride test was given by aceto-acetic acid and not by acetone. Hurtley[4] showed that Rothera had been misled in this conclusion by impure preparations of aceto-acetic acid, the small amount of the ester of aceto-acetic acid present being sufficient to prevent the aceto-acetic acid giving a response to the sodium nitroprusside test.

In view of the above facts it seems that: (i) The term acetonuria is misleading and should be replaced by that of ketonuria. (ii) Statements as to the presence or absence of acetone or aceto-acetic acid, as such, should be avoided.

Incidence of Ketonuria.

It is well known that children very frequently exhibit ketonuria, either without any obvious reason or as a result of even the most minor upsets, and that a definite ketosis may occur in childhood without giving rise to any apparent disturbance of health.

Howland and Marriott[5] suggested that the finding of ketonuria in children, rather than signifying some unusual complication in the course of a disease, should be regarded in the same light as an elevated temperature, occurring as it does with much the same regularity as fever.

Investigators have observed ketonuria in varying percentages of patients admitted to children's wards.

Garland[6] found evidence of ketonuria in only 17·3% of 734 patients (febrile and afebrile) admitted to the Children's wards of the Massachusetts General Hospital, while Frew[7] found that 61·5% of 662 children (febrile and afebrile) admitted to the Hospital for Sick Children, Great Ormond Street, London, had ketonuria.

The other reported figures seem to vary between these two extremes.

As would be expected, the published figures for the evidence of ketonuria are much higher in the febrile than in the afebrile children.

Holt[8] found ketonuria in approximately 70% of children with lobar pneumonia, in contrast to an incidence of approximately 30% among the total admissions to children's wards. Harris[9] has reported an incidence of 85% to 90% in 293 cases of scarlet fever and diphtheria.

Incidence of Ketonuria in a Series of Admissions to the Royal Alexandra Hospital for Children.

I have been unable to find any references to the incidence of ketonuria amongst children admitted to hospital wards in Australia and have attempted to assess this incidence by means of the following study of 685 children admitted to the wards of the Royal Alexandra Hospital for Children, Sydney. The cases have been subdivided primarily according to the absence or presence of fever, and secondarily into two age groups. It was assumed that children over three years of age would probably exhibit more mental distress at being removed from their home surroundings than infants of less than this age, and the cases were divided into these two age groups in the hope that the resultant figures might possibly throw some light on the effect of emotional disturbance on the incidence of ketonuria.

A positive result to the sodium nitroprusside test was accepted throughout this study as evidence of ketonuria, and the collected results have been expressed in tabular form (see Table I).

From a study of this table it will be noticed:

1. That the general incidence of ketonuria, that is 46%, was lower than that found by Frew (61·5%), but higher than that found by Holt (30%).

TABLE I.

Incidence of Ketonuria in 685 Children admitted to the Wards of the Royal Alexandra Hospital for Children.

Group.	Number of Children.	Number of Children with Ketonuria.	Percentage Incidence of Ketonuria.
Children over three years of age ..	363	197	52
A. Febrile	235	163	69
B. Afebrile	128	34	26
Children under three years of age ..	322	126	39
A. Febrile	198	84	42
B. Afebrile	124	42	34
Total children of both age groups ..	685	323	46
Total febrile children of both age groups	433	247	57
Total afebrile children of both age groups	252	76	30

2. That ketonuria was noted in more than half of the febrile and in only 30% of the afebrile children.

3. That the incidence of ketonuria was lower in the children of less than three years of age. It is very doubtful whether this slightly lower incidence of ketonuria in the younger age group should be regarded as evidence in favour of emotional disturbance as one of the causal factors.

As some further attempt at assessing the part played by emotional disturbance in the production of ketones, the incidence of ketonuria was also studied in a small group of afebrile ward children before and after "visiting day" and its usual excitement and tears. Specimens of urine were examined for ketones on Sunday morning (visiting day), on Sunday night and on Monday morning. These specimens did not show any increase in the degree or incidence of ketonuria after the excitement of visiting day.[1]

A similar study of specimens of urine from afebrile ward children before and after visits to the hospital dental clinic also proved negative.

Neither of these results may be regarded as conclusive, for in the first group of children the increased carbohydrate intake, so often associated with visiting day, has not been excluded; and in considering the second group it must be admitted that to the majority of ward children a visit to the dental clinic is little more than an interesting interlude in ward life. But, despite their apparent inconclusiveness, these findings seem to suggest that emotional disturbance *per se* is unlikely to produce ketonuria in the normal child.

HISTORICAL.

Apparently the literature contained no reference to the subject of "cyclic vomiting" until 1840, when Gruere,[10] a physician of Dijon, published his observations on cases of "periodic vomiting" encountered in his own practice. Professor Still's "History of Pædiatrics", which deals with the progress of the study of diseases of children up to the end of the eighteenth century, does not include any mention of periodic or recurrent vomiting.

In 1861, Dr. H. C. Lombard[12] reported several cases which he had observed, and in 1882 Samuel Gee[13] published the details of nine new cases of "fitful or recurrent vomiting", with the aid of which he repainted the picture of this complaint.

During the last decade of the nineteenth century the subject was enthusiastically studied in its various aspects by a number of North American workers. Marfan's work on this subject appeared in 1901, and included several new and important facts. Marfan showed that the attacks were accompanied by an elimination of acetone in the urine and expired air; previously this observation had been recorded only occasionally in isolated reports, without any significance being attached to it. He also contended, contrary to the generally accepted opinion of the time, that this type of vomiting was not dependent upon any affection of the stomach, intestine or appendix.

The twentieth century investigators have produced a most extensive literature dealing with many and various aspects of this condition. The ætiological theories propounded are surprising and multitudinous, varying from recurrent volvulus and congenital subvaterian duodenal stenosis to recurrent uræmic manifestations and allergic disturbances. No attempt has been made to review this mass of literature in its entirety, but references to a number of the more important of these contributions will be found in the text of this study.

DEFINITION.

The terms cyclic vomiting, recurrent vomiting, periodic vomiting, acetonæmic vomiting and the migraine-cyclic vomiting syndrome have been applied somewhat indiscriminately to the repetition at regular or irregular intervals of unexplained vomiting attacks in children. Such attacks are usually accompanied by one or more of the following signs and symptoms: pallor, prostration, headache, visual disturbances, ketonuria, slight fever, constipation and abdominal pain. Vomiting, ketonuria and some degree of prostration may be accepted as the more constant constituents of typical attacks, while any or all of the remaining symptoms and signs may or may not be noted. Usually one or other symptom is predominant, and the presence or absence of any of the others can be detected only by observation and inquiry.

H. C. Cameron[14] pointed out that the majority of children probably respond to a variety of stresses, such as infection, over-excitement, starvation and undue exertion, by developing some degree of ketonæmia; in the great majority this ketonæmia is not accompanied by any visible disturbance of health, but "given a certain temperamental and metabolic inheritance we may recognize a child who develops these disturbances very easily, and the reaction is characteristic".

It seems that the vomiting and the ketonæmia are possibly two concomitant consequences of the same basic disturbance, the nature of which remains unknown. But, as will be suggested later, it is unlikely that the ketonæmia and the vomiting are to be regarded either as cause and effect or effect and cause.

[1] I am indebted to Sister Munro for the collection and testing of these specimens.

It is questionable whether cyclic vomiting should be regarded as a clinical entity dependent on some constant causal factor, but the fact remains that there is a definite, if small, group of children who are subject to repeated and characteristic attacks for which there does not appear to be any obvious explanation; it is this small group which may be accepted, after careful observation and investigation, as examples of the cyclic vomiting syndrome.

DIAGNOSIS.

The most careful attention should be paid to the personal and family history, physical examination and, if possible, to observation during several attacks of any child who is thought to be prone to this syndrome.

A diagnosis of cyclic vomiting is essentially a dangerous one and can rarely be made with any certainty until several seizures have been carefully observed. Even when such a diagnosis appears to have been established, it is most essential that the physician should approach each new attack with the open mind of an investigator, rather than a complacent acceptance of "just another attack".

It is particularly important to exclude such conditions as the following, any of which may be responsible for recurrent attacks of vomiting and ketosis: recurrent upper respiratory tract infections, recurrent attacks of appendicitis, pathological change in the renal tract, chronic intestinal indigestion, intestinal parasites, recurrent vomiting from dietetic errors or idiosyncrasies (? allergy), recurrent partial obstructions of the intestinal tract (particularly those associated with small herniæ) and intracranial disturbances.

I feel that the so-called bilious attack of childhood, which is precipitated by some obvious error in the child's diet (usually an excess of fat) and is frequently accompanied by a slight degree of icterus, is quite distinct from the cyclic vomiting syndrome, and I have endeavoured to exclude any such case from the present study.

A CLINICAL STUDY OF EIGHTEEN CASES OF CYCLIC VOMITING.

The following study of the family history, type of child, sex incidence, age of onset, frequency, duration and nature of attacks is based on the records of the clinical examination and histories of eighteen children who were regarded as furnishing classical examples of the cyclic vomiting syndrome. These eighteen children were observed by me over periods varying from nine months to four years, the majority being under regular observation for nearly two years.

The following routine investigation was attempted. After the first clinical examination the mother attended with her child at intervals of one to two months, when further clinical examinations were carried out, specimens of urine were tested, and notes were made of the child's attacks and general progress. Arrangements were made with the mother to collect a specimen of urine, if she considered an attack was threatening, and if an attack eventuated this specimen and one or more collected during the attack were examined. During the last six months of this study arrangements were made with four of the mothers to test early morning specimens in their own homes and to bring for examination any specimen which appeared to contain ketones.

Whenever feasible, the attacks were personally observed and treated. Unfortunately this was practically impossible in six of the children who came from the more distant suburbs.

Family History.

Many authorities maintain that this condition is rarely found in children of the out-patient class and that the majority of the children affected come from well-to-do families. Leonard Findlay[15] feels that "it is a disease essentially of the non-hospital class". When the present study was commenced these statements were accepted, and the relative frequency of such cases encountered in private practice seemed to support them. But as the study progressed it was found that classical examples of the syndrome were relatively frequent amongst children attending the out-patient department of the Royal Alexandra Hospital for Children. Although this out-patient incidence seemed high, it did not even approach the astounding figures quoted by Osman,[16] who stated that approximately 30% of all children under two years of age attending the out-patient departments of two London hospitals were subject to typical attacks.

As a rule the mother, or perhaps both of the parents, belonged to the more educated, imaginative or "nervously sensitive" class. Many of the family histories included an admission of migraine, of tram, train or car sickness, of asthma or hay fever. The report of migraine, of tram, train or car sickness or of recurrent vomiting attacks in childhood was much more commonly encountered in the mother's history. (See Table III.)

Although a history of asthma or hay fever in some other member of the family was encountered in nearly 40% of the eighteen children under observation, there was nothing to suggest that any of the attacks were allergic in origin. Bray[17] found that children subject to cyclic vomiting do not give positive skin reactions and have normal and high gastric acid curves, while Tallerman,[18] in a recent study of cyclic vomiting, with special reference to allergic factors, concluded that, apart from a slight increase in the frequency of an allergic family history, there was no evidence to support allergy as a causal factor.

Type of Child.

It is difficult to describe the "nervous make-up" of these children; they are essentially quick, alert, easily excitable, tend to be restless and emotionally unstable. The great majority give one the impression of living on an "all-out" principle and are particularly prone to exhaust themselves by the uncontrolled manner in which they throw themselves into any activity. Most of the children

TABLE II.

Observations on the Clinical Histories of Eighteen Cases of the so-called Cyclic Vomiting Syndrome.

Case.	Sex.	Present Age.	Age at Onset.	Interval between Attacks.	Duration of Attacks.	Nature of Attacks.					Liver.	Stools.	Jaundice.	Vasomotor Instability.	Defects of Stance.	Endocrine Disturbance.
						Headache.	Visual Disturbance.	Vomiting.	Temperature.	Abdominal Pain.						
I	M.	Years. 3½	Months. ? 18	2–3 months.	3–4 days.	Present during some attacks, not severe.	–	+	37·2°–37·8° C. (99°–100° F.)	+	Not enlarged.	Pale during and after attacks.	–	+	+ Slight	–
II	M.	9	Years. 6	1 month at first, now about 2 months.	24–36 hours.	++ Right-sided.	? +	++	—	–	Not enlarged.	Normal.	–	Pallor marked after exertion and excitement.		–
III	F.	9	6	2–3 weeks at first, now about 2 months.	24–48 hours.	Frontal, all attacks.	–	+	+ Not constant.	+ Slight.	Not enlarged.	Constipation during, and some days after attacks.	–	Fainting attacks.	+	–
IV	F.	6	5	2–3 weeks.	Average, 24 hours.	Slight headache, as a rule.	–	+	37·2°–37·8° C. (99°–100° F.)	–	Not enlarged.	Putty coloured during some attacks.	–	Frequent attacks of unexplained pallor.	–	–
V	F.	8	5	3–4 weeks.	24–48 hours.	–	–	++	–	+ (Slight).	Liver margin about 1 in. below costal margin.	Normal (slightly constipated).	–	? –	+	
VI	M.	5	Months. ? 18	2 weeks to 1 month +.	Average, 2 days.	Left-sided headache, with all attacks.	? +	– (but marked prostration).	–	Variable.	Not enlarged.	Constipation between and during attacks.	–	+	+	–
VII	M.	12	Years. 6	2–3 weeks.	2–3 days or more.	Headaches, ? frontal.	"Bright lights going round and round."	++	Variable.	–	Not enlarged.	Normal.	–	Frequent attacks of pallor and dizziness.	+	Very dry skin. No other evidence of any endocrine disturbance.
VIII	F.	10	2	2 weeks or more.	8–12 hours, acute attack drowsy and languid 1–2 days after this.	+ (Generalized).	–	+	37·2°–38·3° C. (99°–101° F.)	+ Slight.	Not enlarged.	Pale stools during and for some days after attacks.	–	+	–	–
IX	F.	8	2	Irregular periods varying from 1 week to more than 2 months.	8–18 hours.	Headaches with recent attacks, not present before.	–	+	–	?	Not enlarged.	Pale yellow and constipated during and some days after attacks.	–	+	+	–
X	M.	9	5	6 weeks to 3 months.	12–24 hours.	+ Frontal. ? Right-sided in some attacks.	Sometimes sees "bright flags" during attacks.	+ Very little vomiting, with some attacks.	—	–	Not enlarged.	Constipation.	–	? –	–	–
XI	F.	6	2	2–4 weeks.	Usually less than 24 hours.	–	–	+	–	+	Not enlarged.	Pale yellow stools and mucous with each attack.	–	++	–	–

TABLE II.—*Continued.*

Observations on the Clinical Histories of Eighteen Cases of the so-called Cyclic Vomiting Syndrome.—Continued.

Case.	Sex.	Present Age.	Age at Onset.	Interval between Attacks.	Nature of Attacks.					Liver.	Stools.	Jaundice.	Vasomotor Instability.	Defects of Stance.	Endocrine Disturbance.
					Duration of Attacks.	Headache.	Visual Disturbance.	Vomiting.	Temperature.	Abdominal Pain.					
XII	M.	Years. 8	Years. 3	6 weeks to 2 months.	Approximately 12 hours (majority of attacks). Occasionally 2–3 days.	+ Variable.	–	+	37·2°–37·8° C. (99°–100° F.) most attacks.	+ (Slight).	Not enlarged.	Normal, slight constipation.	–	–	+	–
XIII	F.	7	3½	3–4 weeks.	3–7 days.	+ for first 24 hours of attack.	? "bright spots".	Only vomits once or twice, as a rule. Sometimes no vomiting with attacks.	–	–	Not enlarged.	Pale stools during earlier attacks.	–	Frequent attacks of pallor and giddiness.	+	Slight generalized enlargement of thyroid gland.
XIV	M.	10	7	2–6 weeks.	21–36 hours.	–	–	++	+ (Not constant.)	+	Not enlarged.	Constipated during and for some days after attacks.	–	+	Slight.	–
XV	M.	8	3	2–3 months.	2–5 days.	++	–	+ Marked prostration.	37·2°–38·0° C. (99°–102° F.)	–	Not enlarged.	Normal.	–	"Fainting attacks.	–	–
XVI	F.	15	5	Approximately every 2 weeks at first, now every 2–3 months.	Vomiting 6–8 hours. Headache and prostration 3–5 days.	++	"Splashes of light" with headaches.	+	Slight fever with early attacks. No fever with recent attacks.	–	Not enlarged.	? Normal. Slight constipation.	–	Pallor when apprehensive or tired	+++	– (10% over height for age.)
XVII	F.	7	4	Very variable 10 days to 3 months.	24–48 hours.	+ (variable).	–	+	–	+	Slightly +.	Constipation.	–	–	+	–
XVIII	F.	5	2½	2–3 months.	2–5 days.	–	–	+·+	37·6°–38·9° C. (100°–102° F.)	–	Slightly +.	Dark brown, with mucous during attacks.	–	+	–	–

approximated to the above description, and the word "vital" might well be used in an attempt to define this type of child.

Such defects of stance as rounded shoulders, undue lordosis, flat-feet or hyperextended knees were evidenced in various degrees by these children, and their muscular tone was frequently poor.

Vasomotor instability was often suggested by transient attacks of pallor which occurred after exertion or excitement.

Cameron states that "postural albuminuria" is a common accompaniment of this syndrome, but such a finding proved very rare in the group of children under observation (one doubtful case).

None of the children exhibited any obvious evidence of endocrine disturbance.

Marfan's statement that the liver is frequently increased in size during attacks was not confirmed by the present study. In two of the eighteen children the liver was regarded as being slightly enlarged both between and during the attacks, but this apparent enlargement did not increase during the attacks; in no case was the liver grossly enlarged, nor was jaundice observed with any of the attacks.

During an epidemic of infective jaundice Hampson[19] encountered two families in which in one instance three children out of seven and in the other two out of five acquired the disease; he reported that the five children who became jaundiced gave a history which strongly suggested cyclic vomiting and that such a history was entirely absent in the remaining children of these families.

TABLE III.

Showing details from the Family Histories in Eighteen Cases of the so-called Cyclic Vomiting Syndrome.

Case.	Mother.	Father.	Other Children.	Other Members of the Family.
I	Hay fever. Has had two "nervous breakdowns".	Sub-editor.	Only child.	Paternal uncle, train sickness.
II	Secretarial work before marriage.	Cabinetmaker. "Nervous," ? asthma.	Two other children, well.	Paternal grandmother, asthma.
III	Frequent vomiting attacks in childhood. Now suffers headaches, with accompanying visual disturbances.	Musician.	One sister, suffered from tram and bus sickness.	Maternal grandmother, ? migrainous attacks.
IV	Highly intelligent. Literary ability. Frequent "bilious attacks" and headaches during adult life and in childhood.	Wool expert.	Only child.	
V	School mistress previous to marriage. Tram, train and bus sickness during childhood.	Bank officer.	Sister suffered from similar attacks between six and ten years.	Paternal grandfather, asthma. Maternal grandfather, ? migraine.
VI	Reported to have suffered two "nervous breakdowns".	Chemist.	Three other children, all well.	
VII	Hay fever.	Petty officer, Royal Australian Navy.	Only child.	Maternal grandmother, asthmatic.
VIII	Train and tram sickness until adolescence.	Electrician.	Only child.	
IX	Graduate in arts. ? Migrainous attacks in childhood.	Salesman.		Maternal aunt suffered from similar attacks in childhood.
X	Frequent vomiting attacks in childhood. Now suffers left-sided headaches and ? teichopsia. Hay fever.	Labourer.	One brother and one sister, both subject to tram and train sickness.	Maternal grandmother, asthma.
XI	Shop assistant before marriage.	Labourer, shell shock.	Only child.	
XII	Well.	Commercial artist.	One sister suffers from similar attacks.	
XIII	One-sided headaches sometimes accompanied by "flashes of light".	Bricklayer.	Only child.	
XIV	? Similar attacks in childhood. Children's nurse before marriage.	Salesman.	One other child, well.	Maternal uncle, "takes turns".
XV	Frequent "bilious attacks" in childhood. Now suffers right-sided headaches and train sickness.	Telephone mechanic.	One sister, suffers from similar attacks.	
XVI	Hay fever.	Merchant.	Two other children, well.	
XVII		Solicitor.	Only child.	
XVIII	Severe right-sided headaches. Nightmares ++ for many years.	Merchant, very nervous. Ménière's disease.	Two brothers, well.	Maternal grandmother, asthma.

A history of similar attacks in some other member of the family, eight of the 18 cases (44%).
A history of hay fever or asthma in some other member of the family, seven of the 18 cases (39%).
A history of tram, train, bus or car sickness in some other member of the family, six of the 18 cases (33%).
A history of migraine in some other member of the family, five of the 18 cases (26%).

As it is generally supposed that the liver may play some part in the ætiology of cyclic vomiting, it is possible that these five children were more prone to the virus of infective jaundice than their brothers and sisters because their livers were more susceptible.

In the hope of finding further evidence in favour of this assumption that the child subject to cyclic vomiting attacks is more susceptible to infective jaundice than his fellows, I have searched for a history suggestive of cyclic vomiting in all the cases of infective jaundice which I have encountered during the past two and a half years, and have made particular inquiries about attacks of jaundice occurring among the children susceptible to cyclic vomiting attacks. Out of more than twenty cases of infective jaundice two children were regarded as being prone to cyclic vomiting attacks; while in the group of eighteen children subject to cyclic vomiting attacks there was no report of an attack of infective jaundice. It seemed surprising that the histories of the eighteen "cyclic vomiting" children did not include even one reference to an attack of jaundice, as reports of jaundice are relatively common in similar histories encountered in the literature.

Wylie and Schlesinger[20] have emphasized the fact that many of these children have a raised systolic blood pressure. The blood pressure was estimated in six children of the present series, and the systolic pressure was regarded as probably above the expected level in two of these children.[1] No attempt was made to keep records of the diastolic pressure, as this was found to be extraordinarily variable.

Age of Onset of Attacks.

The average age of onset in this series of eighteen cases was found to be four and a quarter years. In approximately 70% the onset occurred between three and eight years of age, and the remaining 30% suffered their first attack before three years of age.

Sex.

Of the eighteen children under consideration, ten were girls and eight were boys.

Frequency of Attacks.

The mother usually reported that the attacks occurred every two or three weeks at first, and that after a few months the interval lengthened to one of two or three or more months. In two of the children the attacks continued to occur at intervals of a month or less over a period of nearly two years.

In some children the length of the free interval may gradually increase, suggesting some gradual adaptation of the child's metabolism to the underlying disturbance, until the attacks practically disappear during early adolescence.

In this present series the average interval in the early stages was approximately two to three weeks, and in the later stages about seven weeks. In four of the children the attacks were reported at surprisingly regular intervals, while in the remainder they were essentially irregular.[1]

The reported intervals of this present series did not support Frew's[21] statement that the interval between attacks is always three weeks or a multiple of three weeks.

Time of Onset of Attacks.

Investigators of the cyclic vomiting syndrome seem to have given very little attention to the time of onset of attacks. Although it is frequently very difficult to state the exact time of onset of an attack, I have found that the majority of the attacks start during the night or the latter part of the day. Dr. Idris Morgan,[22] who has been interested in the question of cyclic vomiting for many years, has noted that a large number of the attacks begin between 7 p.m. and 12 midnight.

In a small but definite group of these children the attacks usually begin in the early morning, and this time of onset has been stressed by those workers who consider that hypoglycæmia is an important ætiological factor.

The Attacks.

In the classical cases there seemed to be a regular or irregular periodical tendency to fall suddenly from a height of normal health or even exaggerated well-being to a much lower level of pallor and prostration. Usually the mothers were able to recognize some characteristic change in disposition or appearance before an attack, but occasionally the attack came very suddenly and without warning. The attack, as observed in the present series of children, might be artificialy subdivided into three stages: (i) A variable period of excitability and excessive energy (this was a common but not a constant finding). (ii) A stage of pallor and languidness, which was present in all cases and which was often accompanied by headache and sometimes by a surprising degree of prostration. (iii) The stage of nausea and vomiting, which varied greatly in degree and duration, and, although almost constant in the classical attack, was absent in some attacks.

Stage of Excitability and Excessive Energy.

In approximately 70% of the present group it was noticed that many attacks were preceded by a period of almost exaggerated well-being, during which the child's energy was surprisingly great, and that this often was followed by a stage of

[1] Although these blood pressure estimations were repeated on several occasions and every care was taken to put the child at his ease, they must raise the question of what is to be regarded as a normal blood pressure in children of different ages, heights, weights and temperaments. From my own small experience this is an extraordinarily difficult question, and I doubt whether any satisfactory answer is forthcoming at present.

[1] The above attempt at assessing the frequency of attacks was based on the mothers' statements at the time of the children's first clinical examinations. In the course of the study it was found that the intervals between attacks were usually extremely variable and that apparently the mothers' statements as to the frequency or duration of attacks were frequently of doubtful value.

irritability, peevishness and contrariness. This change was so evident in some of the children that their mothers had learned to dread the appearance of this premonitory wave of well-being.

Stage of Pallor and Languidness.

Within a period which varied from less than one to more than twenty-four hours, the children were found to pass on to the second stage, which was characterized by pallor, "dark rings under the eyes", yawning (or, less commonly, sighing), anorexia, languidness, and general apathy. Some children suffered from varying degrees of prostration, slight abdominal discomfort, nausea and headache during this stage. In approximately 30% of the children observed the preliminary signs of excessive energy were absent, and pallor, languidness, anorexia and apathy were the first evidence that an attack was threatening.

In certain of the children this prodromal prostration, pallor, nausea and headache occurred without any culmination in vomiting. I was able to observe three such attacks in one child and two similar attacks in other children, and was astounded to find a degree of prostration and drowsiness which appeared genuinely alarming, despite the fact that there had been no vomiting.

The pallor of this stage seemed to be vasomotor in origin, and although some children appeared sallow, there was no icteric tinge of the skin or mucous membranes.

A slight degree of fever (37·2° to 38·3° C. or 99° to 101° F.) occurred in about 50% of children in this second stage and usually persisted until the attack was practically over.

In one child, a boy of six years (under the care of Dr. Harold Sweetapple) minor convulsive manifestations were noted during this stage of several attacks.

Many authorities have noted some definite change in the appearance of the stools, either during or between the attacks. Over fifty years ago Samuel Gee drew attention to the pallor of the stools during attacks, and recently Reginald Miller[23] has suggested that intestinal indigestion and toxæmia are possibly the underlying causes of the attacks.

Of the group of eighteen susceptible children under observation, the attacks were reported to be accompanied by pale stools in six (33%) and by constipation in eight (44%). Two children of this series were reported to pass mucus with their stools, and their clinical examination and symptomatology suggested that they might possibly be regarded as suffering from chronic intestinal toxæmia in one of its milder forms.

Vomiting.

The severity and duration of the stage of vomiting seemed to be extremely variable. In some children the vomiting did not occur with every attack and rarely persisted for more than eight or ten hours, while in the severe cases the vomiting was a constant feature of attacks and persisted for as long as two or even three days. It was surprising to note that the degree of prostration or drowsiness did not seem to vary in direct proportion to the amount of vomiting, except in those children who suffered from prolonged and persistent vomiting. As has been pointed out above, some attacks are not accompanied by any vomiting and yet rapidly culminate in a pronounced degree of prostration.

Air hunger was not noted in the average attack, but was present to some degree in the majority of the severe attacks.

Abdominal pain did not seem to be as common an accompaniment of the attacks as the literature would suggest, and varied in its degree and time of onset from an initial and leading symptom to a slight soreness of the muscles after prolonged vomiting. In one child, of eight years, in whom the abdominal pain was a definite feature in the early stages of each attack, it was found that fright or apprehension frequently produced similar attacks of abdominal pain, and occasionally a slight ketonuria, without producing the headache and vomiting which accompanied typical attacks.

Approximately 60% of the children complained of or were reported to suffer from a variable degree of headache during this stage, and in about 40% of this group the headache apparently was accompanied by some form of visual disturbance.

The suddenness and rapidity of recovery after almost all the attacks seemed the most dramatic features of the syndrome. To visit and to offer unavailing treatment, for two or even three days, to a child who is vomiting almost incessantly and who appears to be steadily approaching an almost moribund state, to return from the evening visit full of pessimism and anxiety and to find the same child smiling and apparently well the next morning seems to savour of the miraculous.

It is my impression that this dramatic and almost miraculous recovery rarely bears any direct relation to the type of treatment instituted, but is rather the result either of an abrupt cessation of an unknown underlying basic disturbance or of the sudden functioning of some remedial mechanism.

The Over-Tired Child.

In the course of general practice I have seen a certain number of children, usually between the ages of three and ten years, who at the end of a long and exciting day exhibited pallor, dark rings under their eyes, a variable degree of prostration, possibly some headache, and usually a moderate degree of ketonuria, the pallor and the ketonuria being almost constant signs. The great majority of these children seemed to be of the same "vital" type as the children subject to cyclic vomiting, and in most cases there was some evidence of maternal over-anxiety and mismanagement.

The usual history of an attack might be epitomized as follows. The child's day had included much more than the normal amount of emotional and physical stress, there had been no obvious alteration in his diet or appetite, and he had

appeared to be very well until about 5 or 6 p.m., when he returned home pale and languid and refused his evening meal.

Probably most children who reach this stage of what may be termed over-tiredness are naturally relieved by a night's rest and possibly some carbohydrate (from the evening meal), and there is no question of any medical observation or advice. But in the case of the children whose attacks I have just attempted to describe, maternal nervousness and over-anxiety lead to an urgent demand for medical attention, "as the child seems to be sickening for something". The child is found to be pale and languid, his muscles are hypotonic, he is placid or almost drowsy rather than irritable, and his urine contains a variable amount of ketone bodies. Rarely there is a slight unexplained elevation of temperature, which usually subsides by the next morning. In its more severe forms this disturbance of health may persist for more than twelve hours and may be accompanied by some abdominal pain or even vomiting, but as a rule it is relieved rapidly by rest and possibly some extra carbohydrate.

I have emphasized this very minor and transient disturbance of health because I have been interested in the close similarity between this condition and the earlier stages of an attack of cyclic vomiting. Although there does not appear to be any periodicity of these attacks, I have been struck by the facts that the family history and the nervous make-up of these children are similar to those of the children subject to cyclic vomiting attacks and that in both groups of children some undue excitement or anxiety frequently seems to be the actual precipitating factor.

It is the absence of unexplained periodic attacks of vomiting which distinguishes this syndrome of the over-tired child from that of cyclic vomiting. The condition seems to be closely related to the cyclic vomiting syndrome and apparently represents the characteristic reaction of a certain type of child to undue emotional or physical stress or both.

Quantitative Estimations of Ketone Bodies in the Urine during Artificial Ketogenesis.

It is difficult to obtain from the literature satisfactory statements as to the concentration of ketone bodies in the blood and urine of normal children, as the few investigators in this field have not used similar methods and have expressed their rather variable results in different terms. Graham and Brown, using Van Slyke's method, estimated the total acetone bodies in the blood and urine of nineteen children. The resultant figures for blood acetone varied from 0 to 1·7 milligrammes per 100 cubic centimetres, and for urinary acetone from 0 to 17·0 milligrammes per 100 cubic centimetres. Van Slyke, in a similar study, found that the blood acetone varied from 1·3 to 2·8 milligrammes per 100 cubic centimetres, and the average figure for urinary acetone was 2·8 milligrammes per 100 cubic centimetres.

Graham and Morris state that the degree of ketonuria runs more or less parallel with the degree of ketonæmia. Graham and Brown studied the relation of the excretion of ketone bodies in the urine to the degree of ketonæmia in children receiving ketogenic diets, and their results, embodied in graph form, illustrate the similarity of the curves for ketonæmia and ketonuria.

Assuming this approximate parallelism of ketonæmia and ketonuria, the present study has been limited to quantitative estimations of urinary ketones.

Artificial Ketosis in Children.

Attempts to define the "normal" ketogenic/antiketogenic ratio of a diet have produced rather contradictory results, the figures for the "normal" ratio varying from 1:1 to 2:1. The majority of investigators agree that the excretion of ketone bodies in the urine is negligible until the diet ketogenic/antiketogenic ratio is greater than 1, and that a significant ketonuria appears in children at a much lower ketogenic/antiketogenic ratio than in adults. Although a few investigations had been carried out in children, the literature on this subject was almost entirely derived from adult studies, until ketogenic diets began to be used in the treatment of epilepsy. Since the introduction of therapeutic ketogenic diets a number of workers have established that the normal child, receiving a diet with a caloric value equal to his basal caloric requirements *plus* 50% and a protein allowance of two grammes per kilogram, rarely shows any evidence of ketosis until a ketogenic/antiketogenic ratio of 1·5:1 is reached.

Graham and Brown,[24] studying normal children, found that a rise in the blood acetone was frequently apparent after twenty-four hours of a ketogenic diet and that it usually reached its peak at the end of a week. After the first week there was often a fall in the blood acetone level, suggesting that the child's metabolism had been adjusted to the ketogenic diet.

Graham and Brown also showed that if a child in whom ketosis had been produced for some days on a diet of a ketogenic/antiketogenic ratio of perhaps 3 : 1 was given only just sufficient glucose to reduce the ketogenic/antiketogenic ratio to 2 : 1, the ketosis frequently subsided completely. Probably these findings may be taken as further evidence of the body's ability to adjust its metabolism to the altered dietetic conditions—possibly by the time the glucose was supplied the body had so adjusted its metabolism that this slight alteration in the diet was sufficient to overcome the ketosis, even although the ketogenic/antiketogenic ratio remained at 2 : 1.

This metabolic adaptation to a ketogenic diet seems to be well evidenced by the Eskimos, whose known resistance to ketogenesis is probably a result of their high fat diet.

Wylie and Schlesinger[20] state that artificially produced ketosis, either in normal children or in those subject to cyclic vomiting, frequently fails to produce vomiting, and that ketonuria appears more rapidly and is more intense in the child subject to cyclic vomiting than in the normal child.

Ross and Josephs[22] submitted a child who was subject to cyclic vomiting attacks to a starvation diet and found that he became drowsy and suffered from ketosis and was hypoglycæmic (his blood sugar varying between 0·055%

and 0·077%), but did not vomit and even showed a tendency to spontaneous improvement during the experiment. At a later date the same child was given a high fat and low carbohydrate diet for a period of about seven days; slight hypoglycæmia and well marked ketosis resulted, but there were no signs or symptoms of a classical attack.

Graham and Morris[36] found that the artificial production of ketosis during a period of good health did not precipitate an attack in a child susceptible to cyclic vomiting. They noted that although the child's blood carbon dioxide was reduced and the ketonuria was intense, "no vomiting ensued and clinically there was no resemblance to an attack of cyclic vomiting". From a study of a child carried out during an actual attack they concluded that the vomiting "was probably the result and not the cause" of the ketonuria and the non-gaseous acidosis.

By starving two children for a short time before operation Ellis[37] was able to demonstrate that a considerable post-anæsthetic ketosis can exist without necessarily giving rise to vomiting. He also produced ketosis in two children before tonsillectomy by means of ketogenic diets, and found that they did not vomit any more than the normal child does after an anæsthetic. The same author reports that in two children subject to cyclic vomiting ketosis was produced by means of a high fat and low carbohydrate diet, but the children did not exhibit any nausea or vomiting.

Present Study of Artificial Ketosis.

The above reports include only one study of the actual degrees of ketonuria produced by ketogenic diets of varying ratios in a child subject to cyclic vomiting attacks. This investigation was carried out by Ross and Josephs, and includes a series of quantitative estimations of urinary ketones, but is limited to the one case of cyclic vomiting.

With the object of observing the responses of a group of cyclic vomiting children to varying degrees of ketogenic diet and of contrasting these results with those obtained in a group of normal children receiving similar diets, quantitative estimations of the degree of ketonuria and other observations were carried out on two groups of children during the winters of 1933 and 1934.

A group of four children from the wards of the Royal Alexandra Hospital for Children, who were receiving therapeutic ketogenic diets, were used as control cases. No child whose history in any way suggested the cyclic vomiting syndrome was included in this group. Four children who after careful observation and study were regarded as typical of the cyclic vomiting syndrome formed the second group.

The following procedure was adopted. The ordinary ward diet (with an approximate ketogenic/antiketogenic ratio of 1:4) was given for thirty-six to forty-eight hours, during which period the child was observed for fever or symptoms of any illness and the urine was measured and examined.

At the end of this observation period, which covers the usual time of appearance of the ketonuria associated with admission to hospital (Frew[7]), the ketogenic diet was commenced. All of these children were confined to bed throughout the investigation, their urinary output was measured daily or every second day, and early morning specimens of urine (to which toluene had been added) were examined quantitatively for ketone bodies by Nanavutty's modification of Van Slyke's method (see below).[1]

A ketogenic/antiketogenic ratio of 1·25:1 or 1·5:1 was given on the first day, and this was increased to 1·75:1 or 2:1 within a few days. Further increases in the ratio varied with the willingness of the child to take the full amount of the diet. Although the sudden introduction of a high ketogenic/antiketogenic ratio would have been possibly of more interest experimentally than a gradual increase in this ratio, it was soon realized that, even on the coldest days, children would not immediately take such a diet.

Because of the obvious difficulty of persuading a child to take such a diet during the hot summer months, these dietetic studies were limited to the cooler months of the year. It was pleasantly surprising to notice how cheerfully and almost enthusiastically the majority of these children dealt with diets which probably would have nauseated the average adult. With a little thought and some reference to the individual child's likes and dislikes such diets can be made quite palatable.

Methods of Quantitative Estimation of Ketone Bodies in the Urine.

The use of some accurate quantitative method is obviously essential for a study of this nature, the routine qualitative tests giving little idea of the actual amount of ketone bodies present in the urine. The usual methods of quantitative estimation of ketone bodies in the urine are essentially tedious, involve the expenditure of much time, and are very rarely carried out in the ordinary clinical laboratory.

Van Slyke's Original Method.[38]

As a preliminary to the choice of a method which would prove sufficiently accurate without being unduly time-consuming, a small series of estimations was carried out on solutions of acetone of known strength by Van Slyke's original method. This is a gravimetric method and is based on a combination of Shaffer's oxidation of β-hydroxybutyric acid to acetone and Denige's precipitation of acetone as a basic mercuric sulphate compound, the total procedure occupying approximately four and a half to five hours. The error with this procedure, when solutions of acetone of known strength are used, was found to vary from less than 4·0% up to 6·0%. Titration of the precipitate (suggested by Van Slyke as an alternative procedure), instead of the usual drying and weighing, did not seem to increase the percentage of error.

Nanavutty's Modification of Van Slyke's Method.

In 1932 Nanavutty[29] published a description of a modification of Van Slyke's method for use with small volumes of blood and urine. With the detailed use of Nanavutty's method certain difficulties were encountered in practice which seemed to detract

[1] It was fully realized that the examination of the total output of the kidneys over a given period would have been the most satisfactory method. Unfortunately this method was found to be impracticable owing to the difficulty experienced in the accurate collection of the total urine from children, and for this reason the above procedure of examining one morning specimen of urine was adopted.

slightly from its accuracy, and the procedure was therefore modified in certain minor respects.

Nanavutty's original method is as follows:

Glucose and other interfering substances are removed from the urine by the following method. Four cubic centimetres of distilled water, one cubic centimetre of the urine, two cubic centimetres of copper sulphate (20%), and two cubic centimetres of calcium hydroxide suspension (10%) are mixed together in a stoppered graduated tube. This mixture is tested with litmus paper and, if still acid in reaction, more calcium hydroxide is added drop by drop until the reaction is alkaline. The mixture is then made up to 10 cubic centimetres with distilled water, allowed to stand for 30 minutes, and then filtered.

Oxidation of β-hydroxybutyric acid and separation of the mercury-acetone compound: Four cubic centimetres of the urine filtrate, 14 cubic centimetres of distilled water, 3 cubic centimetres of 14 N sulphuric acid, and 5 cubic centimetres of acid mercuric sulphate solution (prepared by dissolving 45·6 grammes of pure red oxide of mercury in one litre of 2·5 N sulphuric acid) are poured into a 100 cubic centimetre conical flask, which is then connected with a reflux condenser. When the contents of the flask have been brought to the boil, 2 cubic centimetres of 5% potassium bichromate are run down the tube into the flask.

Gentle ebullition is maintained for thirty minutes. After thorough cooling the contents are filtered through nine centimetre retentive paper without suction and the precipitate is washed free from reagents with distilled water. The filter paper is then unfolded and dropped into five cubic centimetre of N hydrochloric acid in a beaker, which is heated gently until the precipitate has dissolved, and then cooled to room temperature.

It was found that the washing of the precipitate collected on filter paper proved difficult and that the resulting mixture of filter paper, precipitate and hydrochloric acid was not satisfactory for accurate titration. The above procedure was not followed, but the precipitate was collected in a Gooch crucible. The crucible, packed with asbestos, was fitted into a vacuum pump holder and the collected precipitate washed with approximately 200 cubic centimetres of distilled water. The washed filtrate and asbestos were gently heated in five cubic centimetres of N hydrochloric acid and allowed to cool.

Titration of mercury in the mercury-acetone compound: Two cubic centimetres of 40% sodium acetate solution and one to two drops of 10% sodium sulphite are added and then five cubic centimetres of 3·3% potassium iodide solution. The sulphite is added to reduce any chromate derived from the mercury-acetone compound; otherwise iodine is liberated from the chromate, thus introducing an error of about 7%.

From a burette the M/20 mercuric chloride is run in until a reddish precipitate persists when viewed against a blue tile.

Microburettes graduated to 0·01 cubic centimetre were used and a white tile was substituted for the blue tile suggested. Owing to the marked and rapid deterioration of the sodium sulphite and sodium acetate solutions, it was found advisable to use freshly prepared solutions of these substances for each estimation.

A blank titration of the potassium iodide solution against the mercuric chloride should be made before each series of estimations.

In the blank titration, five cubic centimetres of the potassium iodide solution are balanced by the added M/20 mercuric chloride. In the test titration a portion of five cubic centimetres of the potassium iodide solution has combined with the mercuric chloride formed by solution in the hydrochloric acid of the mercury contained in the mercury-acetone precipitate; the rest of the five cubic centimetres of the potassium iodide solution is balanced by the mercuric chloride required to complete the titration. Therefore the difference between blank titration and the test titration (that is, M/20 mercuric chloride deficiency) measures the quantity of acetone bodies in the amount of urine filtrate used.

As the estimations, carried out by this procedure, on solutions of acetone of known strength were usually completed in less than two and a half hours and showed an error of only 5%, the method was adopted for the purposes of the present study.

Suggested Method for the Approximate Quantitative Assessment of the Amount of Ketone Bodies in the Urine by the Application of Rothera's Test to Varying Dilutions of Urine.

Rothera's sodium nitroprusside test is valuable, as it responds to both acetone and aceto-acetic acid, but because of its extreme sensitivity (it will detect acetone in a dilution of 1 in 20,000 and aceto-acetic acid in dilutions of 1 in 400,000) a positive result should be appraised in some quantitative manner, if possible.

Kenneway,[30] writing in 1913, suggested that a "quick strong" reaction (that is, a deep permanganate colour appearing in a few seconds) occurred in response to Rothera's test in urine containing 0·25% aceto-acetic acid, and that a "slow weak" reaction (that is, a pink colour appearing after several minutes) resulted in urine containing 0·0005% of aceto-acetic acid. A search of the literature did not reveal any other suggestions for the approximate quantitative assessment of the degree of ketonuria.

Although the rate of development and the depth of the colour noted with Rothera's test afford a rough indication of the degree of ketonuria, it was thought that some more accurate measure of the quantity of ketone bodies might be afforded by applying this test to varying dilutions of urine. With the object of establishing a simple dilution test of this nature, the following method of testing was applied to every specimen of urine which was examined by Nanavutty's quantitative method.

The usual Rothera's test was carried out with a specimen of undiluted urine and with specimens of urine and distilled water prepared in dilutions of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{32}$ *et cetera*; and in order to attain some degree of uniformity, all tests were read at the end of one minute and the appearance of an amethyst ring was accepted as a positive reaction.

Although the results were more variable than had been expected, they may be recorded as varying between the extremes noted in Table IV, which is based on the results obtained with 72 specimens of urine which had been subjected to Nanavutty's quantitative method.

This simple dilution quantitative test was used on a certain number of specimens of urine collected during or between attacks of cyclic vomiting, and proved to be an excellent method for rapid estimation of the approximate degree of ketonuria.

TABLE IV.

Urine Dilution.	Rothera's Test. (Within 60 Seconds.)	Amount of Ketone Bodies. (Milligrammes per 100 Cubic Centimetres.)
Undiluted	+[1]	Probably less than 15.
½	+	Approximately 20 to 30.
¼	+	Approximately 40 to 75.
⅛	+	Approximately 75 to 200.
1/16	+	Approximately 175 to 250.
1/32	+	Approximately 250 to 350.
1/64	+	Over 320.

[1] Positive.

DISCUSSION OF THE RESULTS OF ARTIFICIAL KETOSIS PRODUCED BY MEANS OF KETOGENIC DIETS IN FOUR "NORMAL" CHILDREN AND IN FOUR CHILDREN SUBJECT TO ATTACKS OF CYCLIC VOMITING.

The results of quantitative estimations of ketone bodies in the urine and of clinical observation of two groups of children (four normal children and four that were subject to cyclic vomiting) before, during and after artificial ketosis was produced have been recorded in the accompanying tables. (See Tables V, VI, VII, VIII, IX, X, XI and XII.)

Artificial Ketosis of Four Normal Children.

A study of the tabulated results of producing artificial ketosis in four normal children reveals the following facts:

1. A ketogenic/antiketogenic ratio of 1·5:1·0 rarely produced any ketonuria.

2. A ketogenic/antiketogenic ratio of 2·0:1·0 usually produced a ketonuria of 20 to 50 milligrammes per 100 cubic centimetres within twenty-

TABLE V.

Showing Results of Estimation of Ketone Bodies in Normal Patient, Number I.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/ Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1:4 (approx.)	1,800	C.cm. 800	Nil.	−	Not detected.	
2	Ketogenic.	1·5:1·0	1,720		Nil.	−		
3	Ketogenic.	2·0:1·0	1,720	500	26	Undiluted. + ½ dilution. Faintly +	Not detected.	Good colour. Bright and cheerful. Bowels open. No nausea. No drowsiness.
4	Ketogenic.	3·0:1·0	1,736		16	Undiluted. + ½ dilution. −		Good colour. Bright and cheerful. Bowels open. No nausea. No drowsiness.
5, 6	Ketogenic.	3·0:1·0	1,736					
7	Ketogenic.	3·0:1·0	1,736	750	34	½ dilution. + ¼ dilution. + ⅛ dilution. Faintly +	+	Good colour. Bright and cheerful Bowels open. No nausea. No drowsiness.
8, 9	Ketogenic.	3·0:1·0	1,736	620				
10	Ketogenic.	3·0:1·0	1,736	540	69	½ dilution. + ¼ dilution. + 1/8 dilution. −	+?	No nausea or other symptoms. Tiring of diet, but still taking it fairly well.
11, 12, 13	Ketogenic.	3·0:1·0	1,700 (approx.)					
14	Ketogenic.	3·0:1·0	1,700 (approx.)	600	54	½ dilution. + ¼ dilution. Very faintly +	Not detected.	

[1] + indicates reaction; − indicates no reaction.

four hours, while a ratio of 3·0 : 1·0 was found to produce, after variable periods, a ketonuria varying from the extremes of 16 to 720 milligrammes per 100 cubic centimetres of urine.

3. No obvious increase in the urinary output was noted, even when the ketone bodies exceeded 100 milligrammes per 100 cubic centimetres of urine.

4. Breath acetone was found to be a surprisingly variable and unreliable sign, its presence and degree being rarely proportionate to the degree of ketonuria. For instance, in one child it was noted when the urine contained 33·95 milligrammes of ketone bodies per 100 cubic centimetres, while in another child it was not detected at a time when the

TABLE VI.

Showing Results of Estimation of Ketone Bodies in Normal Patient, Number II.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)[1]	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[2]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0 : 4·0 (approx.)	1,500 (approx.)		Nil.	−	Not detected.	
2	Ketogenic.	1·25 : 1·0	1,470		Nil.	−	Not detected.	
3	Ketogenic.	1·5 : 1·0	1,492		Nil.	−	Not detected.	
4	Ketogenic.	2·0 : 1·0	1,496		29	½ dilution. + ⅓ dilution. Faintly +	Not detected.	Bright and cheerful. Good colour. No nausea. Taking diet well.
5	Ketogenic.	3·0 : 1·0	1,505			Undiluted. +	Not detected.	
6	Ketogenic.	3·0 : 1·0	1,505		164	½ dilution. + 1/5 dilution. Faintly + ⅛ dilution. −	++	
7	Ketogenic.	3·0 : 1·0	1,505		720	1/64 dilution. + 1/128 dilution. −	++	No obvious increase in breath acetone since yesterday. No change in appetite. Prefers cream, butter, and cod liver oil to vegetables.
8	Ketogenic.	3·0 : 1·0	1,505				Not detected.	
9	Ketogenic.	3·0 : 1·0	1,475 (approx.)		134	½ dilution. + ⅓ dilution. + ⅛ dilution. Faintly +	Not detected.	
10, 11, 12	Ketogenic.	3·0 : 1·0	1,475–1,500					
13	Ketogenic.	3·0 : 1·0	1,470–1,500 (approx.)		97	½ dilution. + ⅛ dilution. −	Not detected.	
14	Ward diet.	1·0 : 4·0 (approx.)	1,500 (approx.)			Undiluted. +		
15	Ward diet.	1·0 : 4·0 (approx.)	1,500 (approx.)		20	Undiluted. + ½ dilution. −	? +	
16	Ward diet.	1·0 : 4·0 (approx.)	1,500 (approx.)		Nil.	−	Not detected.	
17	Ward diet.	1·0 : 4·0 (approx.)	1,500 (approx.)		Nil.	−	Not detected.	No obvious alteration in child's condition since cessation of ketonuria.

[1] Owing to the obvious difficulty of collecting the urine from children of less than three years of age, no attempt has been made to record the amount of urine passed by these children.

[2] + indicates reaction; − indicates no reaction.

urine contained 134·3 milligrammes per 100 cubic centimetres.

5. It was found that gross ketonuria was not accompanied by the pallor, headache, languidness, nausea or vomiting which have been regarded by some authorities as clinical results or accompaniments of ketosis.

One child, a girl of two years, afforded an excellent example of a gross and yet symptomless ketonuria. This child's urine was found to contain 720 milligrammes of ketones per 100 cubic centimetres, and yet she did not exhibit any obvious change in her clinical condition, continued to take her ketogenic diet well, and even showed some preference for cream, butter and cod liver oil.

6. Some of the degrees of ketonuria encountered in this study of artificial ketosis were much higher than those exhibited by children during some apparently classical attacks of cyclic vomiting.

7. In the majority the degree of ketonuria reached its maximum after seven to twelve days of the ketogenic diet and then fell to a lower level, even though the same diet was continued.

8. As a rule the ketonuria persisted for twenty-four to forty-eight hours after a return to the usual ward diet.

9. No obvious change in the appearance of the stools was noted during this artificial ketosis.

TABLE VII.

Showing Results of Estimation of Ketone Bodies in Normal Patient, Number III.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/ Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)[1]	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[2]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0 : 4·0 (approx.)	1,100–1,200 (approx.)		Nil.	–	Not detected.	
2	Ketogenic.	2·0 : 1·0	1,049		Nil.	–		
3	Ketogenic.	2·0 : 1·0	1,049		32	½ dilution. + ¼ dilution. Faintly +	Faint.	Colour normal. Clean tongue. No nausea. Bowels open. No headache.
4	Ketogenic.	2·5 : 1·0	1,050		55	½ dilution. + ¼ dilution. Faintly +	Not detected.	
5	Ketogenic.	2·5 : 1·0	1,050					
6	Ketogenic.	2·5 : 1·0	1,050		12	Undiluted. Faintly + ½ dilution. –		Condition unaltered. Very cold weather. Taking diet well.
7, 8, 9	Ketogenic.	2·5 : 1·0	1,050					
10	Ketogenic.	3·0 : 1·0	1,060		105	½ dilution. + ¼ dilution. –	++	
11	Ketogenic.	3·0 : 1·0	1,060					
12	Ketogenic.	3·0 : 1·0	1,060		262	1/20 dilution. + 1/40 dilution. –	+	Condition unaltered. No symptoms Still taking diet well.
13	Ward diet.	1·0 : 1·4 (approx.)	1,100–1,200 (approx.)					
14	Ward diet.	1·0 : 1·4 (approx.)	1,100–1,200 (approx.)		112	½ dilution. + ¼ dilution. –	? +	
15	Ward diet.	1·0 : 1·4 (approx.)	1,100–1,200 (approx.)					
16	Ward diet.	1·0 : 4·0 (approx.)	1,100–1,200 (approx.)		Nil.	–	Not detected.	No obvious alteration in child's appearance or condition since cessation of ketonuria.

[1] Owing to the obvious difficulty of collecting the urine from children of less than three years of age, no attempt has been made to record the amount of urine passed by these children.

[2] + indicates reaction; – indicates no reaction.

Artificial Ketosis of Four Children subject to Attacks of Cyclic Vomiting.

A study of the tabulated results of producing ketosis in four children that were subject to attacks of cyclic vomiting reveals the following facts:

1. In one child a very minor degree of ketonuria resulted from a ketogenic/antiketogenic ratio of 1·3:1·0, but in the other four children no ketonuria resulted until the ketogenic/antiketogenic ratio exceeded 1·5:1·0. These findings would suggest that the threshold for ketogenesis (by means of ketogenic diets) in the child subject to cyclic vomiting attacks is practically the same as that for the normal child.

2. A ketogenic/antiketogenic ratio of 2·0:1·0 produced within twenty-four hours a ketonuria varying between 10 and 68 milligrammes per 100 cubic centimetres. After periods varying from two to five days on a diet of this ratio the degree of ketonuria was found to vary between approximately 40 and 300 milligrammes per 100 cubic centimetres. One child exhibited a ketonuria of 600 milligrammes per 100 cubic centimetres after only forty-eight hours on a diet of this ratio.

These results suggest that although the threshold for ketogenesis (by means of ketogenic diet) is approximately the same in both groups of children, the resultant degree of ketonuria is possibly a little more intense in the child subject to cyclic vomiting attacks.

3. As in the case of the normal children, no obvious increase in the urinary output was noted, even when the ketone bodies exceeded 100 milligrammes per 100 cubic centimetres of urine, and the breath acetone was found to be a surprisingly variable and unreliable sign.

4. As the majority of these children had been given diets of restricted fat and unlimited carbohydrates for some months or even years, it seemed surprising to find them taking these ketogenic diets with very little complaint and without any apparent nausea or other disturbance. It was even more surprising to find that the resultant ketonuria, even when intense (the maximum figures in these four children varying from 180 to 600 milligrammes of ketone bodies per 100 cubic centimetres of urine), was not accompanied by the pallor, headache, languidness, nausea or vomiting which has been regarded by some authorities as a clinical result or accompaniment of ketosis in such children.

5. It was observed that the degree of ketonuria produced in two of these children by means of this

TABLE VIII.

Showing Results of Estimation of Ketone Bodies in Normal Patient, Number IV.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/ Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0:4·0		C.cm. 450	Nil.	−	Not detected.	
2	Ketogenic.	1·0:1·0	1,700	930		Undiluted. Faintly +	Not detected.	
3	Ketogenic.	2·0:1·0	1,720	650	49	½ dilution. + ¼ dilution. −	Faint.	No obvious alteration in clinical condition.
4	Ketogenic.	2·0:1·0	1,720					
5	Ketogenic.	2·0:1·0	1,720					
6	Ketogenic.	2·0:1·0	1,720	480	33	½ dilution. + ¼ dilution. −	Faint.	
7	Ketogenic.	2·0:1·0	1,720		Probably less than 20	Undiluted. + ½ dilution. −		
8	Ketogenic.	3·0:1·0	1,730	750	92	½ dilution. + ¼ dilution. +	++	No change in colour. No nausea. Not constipated.
9	Ketogenic.	3·0:1·0		390?				
10	Ketogenic.	3·0:1·0	1,730		79	½ dilution. + ¼ dilution. −	?+	

[1] + indicates reaction; − indicates no reaction.

artificial ketogenesis was higher than that exhibited by the same children during apparently classical attacks of cyclic vomiting.

6. The general trend of opinion seems to suggest that a ketogenic diet (or rather the resultant ketosis) would be likely to precipitate an attack of cyclic vomiting in the "susceptible" child, and the mothers of the "susceptible" children investigated in this study naturally expressed varying degrees of fear and apprehension at the thought of such a diet being given to their children. These mothers were astounded to find their children after several days of such diets cheerful, well and not even nauseated. Two mothers were so impressed by the improvement in their children's general condition and appearance under such a *régime* that they asked whether they should adopt it as a routine diet. Without attempting to debate this stimulating lay query, it is of interest to observe that a ketogenic diet has been advocated for the treatment of migraine (a possible mutation of cyclic vomiting).

7. No obvious change in the appearance of these children's stools was noted during the period of artificial ketosis.

At an earlier stage of this study two attempts were made to persuade one of these susceptible

TABLE IX.

Showing Results of Estimation of Ketone Bodies in Cyclic Vomiting Syndrome Patient, Number I.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0 : 4·0 (approx.)	1,300 (approx.)	C.cm. 990	Nil.	–	Not detected.	
2	Ketogenic.	1·5 : 1·0	1,291	600+	Nil.	–	Not detected.	
3	Ketogenic.	1·5 : 1·0	1,291	660	Nil.	–	Not detected.	
4	Ketogenic.	2·0 : 1·0	1,291	510+	32	⅓ dilution. + ½ dilution. Faintly + 1 dilution. –	Not detected.	
5	Ketogenic	2·0 : 1·0	1,291					
6	Ketogenic.	2·0 : 1·0	1,291	540	205	1/15 dilution. + 1/30 dilution. Faintly + 1/60 dilution. +	+	Seems well. Good colour. Spends much time in reading—no headache. No nausea. Taking diet well. Stools normal and regular.
7	Ketogenic.	2·0 : 1·0	1,291					
8	Ketogenic.	2·0 : 1·0	1,291	490+	290	1/30 dilution. + 1/60 dilution. Faintly +	? +	Condition unaltered.
9, 10	Ketogenic.	2·0 : 1·0	1,291					
11	Ketogenic.	2·0 : 1·0	1,291	440+	164	⅓ dilution. + ½ dilution. Faintly + 1 dilution. –	Not detected.	Condition unaltered. Tiring of diet a little.
12	Ketogenic.	2·0 : 1·0	1,200		82	⅓ dilution. + ½ dilution. –	++	
13	Ward diet.	1·0 : 4·0 (approx.)	1,300+ (approx.)		90	⅓ dilution. + ½ dilution. –	? +	
14	Ward diet.	1·0 : 4·0 (approx.)	1,300+ (approx.)		Nil.			No obvious alteration in child's condition or appearance since cessation of ketonuria.

[1] + indicates reaction; – indicates no reaction.

children to take a ketogenic diet at home. Both attempts were complete failures; the mother reported that the child became nauseated and even vomited once or twice after barely twenty-four hours of the diet. And yet this same child, while in hospital and under ward discipline, was able to take a ketogenic diet of much higher ratio without any apparent disturbance of health. Two other susceptible children (not included in this present group) were reported to have become nauseated and to have vomited after twenty-four to forty-eight hours of a modified ketogenic diet given in their homes.

While discussing the results of artificial ketosis of children susceptible to cyclic vomiting I should like to emphasize two cases in particular and to contrast the degree of ketonuria exhibited by these children during attacks of cyclic vomiting with that produced artificially by means of the ketogenic diet.

CYCLIC VOMITING SYNDROME. CASE I.—J.W., a boy of nine years, had suffered from attacks of vomiting and headache since six years of age. His paternal grandmother had suffered from asthma and his father was reputed to have occasional attacks of asthma and hay fever.

Without any obvious explanation this boy suddenly becomes pale and listless, lies down and complains of headache. Within an hour or even sooner he begins to vomit and usually continues vomiting for twelve to twenty-four hours. His attacks occur at intervals of one to two months or longer. Fortunately I was able to examine specimens of urine collected during two of his attacks. The results are shown in Table XIII.

In reviewing the figures in Table XIII it is interesting to note: (i) That during the first eighteen to twenty hours of each of these two attacks, when this boy was prostrated and vomiting, the degree of ketonuria was less than 100 milligrammes per 100 cubic centimetres and that the maximum degree of ketonuria encountered did not exceed 250 milligrammes per 100 cubic centimetres in either attack.

TABLE X.

Showing Results of Estimation of Ketone Bodies in Cyclic Vomiting Syndrome Patient, Number II.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0 : 4·0 (approx.)		C.cm. 450+	–		Not detected.	
2	Ward diet.	1·0 : 4·0 (approx.)		600	–		Not detected.	
3	Ketogenic.	1·5 : 1·0	2,083	750	–		Not detected.	
4	Ketogenic.	1·5 : 1·0	2,083	720	–		Not detected.	
5	Ketogenic.	1·5 : 1·0	2,083	440	Less than 10	Undiluted. + ½ dilution. –	Not detected.	Normal colour. No headache. No nausea. Shows some distaste for diet.
6	Ketogenic.	1·5 : 1·0	2,083	510			Not detected.	
7	Ketogenic.	2·0 : 1·0	2,100 (approx.)	450	10	Undiluted. + ½ dilution. –	Not detected.	Taking diet better.
8	Ketogenic.	2·0 : 1·0	2,100 (approx.)	600	90		Not detected.	
9	Ketogenic.	2·0 : 1·0	2,100 (approx.)	570	58		Not detected.	No complaint about diet now. Taking food well. No nausea. No pallor. No headache.
10	Ketogenic.	2·0 : 1·0	2,100 (approx.)	450			Not detected.	
11	Ketogenic.	2·0 : 1·0	2,100 (approx.)	400	180			
12	Ketogenic.	2·0 : 1·0	2,100 (approx.)	580				

[1] + indicates reaction; – indicates no reaction.

Perhaps, in view of the very small number of specimens examined, it would be incorrect to suggest that the degree of ketonuria did not exceed 250 milligrammes per 100 cubic centimetres at some stage in either attack; but it seems reasonable to assume that when this boy's symptoms were well marked and had been present for several hours his ketonuria probably did not exceed 100 milligrammes per 100 cubic centimetres of urine. (ii) Yet when artificial ketosis was produced in this same boy by means of a ketogenic diet he exhibited a degree of ketonuria, varying from 164 to 290 milligrammes per 100 cubic centimetres of urine, over three days without any evident change in appearance or disturbance of health.

I have emphasized these observations as I feel that they should help to establish the probable fact that the ketosis is merely an accompaniment of some unknown basic disturbance and cannot be regarded as essentially the cause of the attack or the result of the vomiting.

CYCLIC VOMITING SYNDROME. CASE IV.—A.H., a boy of nine years, had suffered from attacks of vomiting since five years of age. His mother states that she suffered from

TABLE XI.

Showing Results of Estimation of Ketone Bodies in Cyclic Vomiting Syndrome Patient, Number III.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes.
1	Ward diet.	1·0 : 4·0 (approx.)		C.cm. 900	Nil.	–	Not detected.	
2	Ketogenic.	1·3 : 1·0	1,352	600	Nil.	–	Not detected.	
3	Ketogenic.	1·3 : 1·0	1,352		Nil.	–	? +	
4	Ketogenic.	1·3 : 1·0	1,352	500	Less than 20	Undiluted. + ⅓ dilution. –	+	
5	Ketogenic.	1·3 : 1·0	1,352		22	⅓ dilution. + ½ dilution. –	++	Normal colour. No nausea. Bright and active. Normal stool daily or second daily.
6	Ketogenic.	2·0 : 1·0	1,489	560				
7	Ketogenic.	2·0 : 1·0	1,489	800	54	⅓ dilution. + ½ dilution. Faintly – ⅓ dilution. –	Faint.	Taking diet well.
8	Ketogenic.	2·0 : 1·0	1,489	690	Probably more than 40	⅓ dilution. + ½ dilution. + ⅓ dilution. –	+	
9	Ketogenic.	2·0 : 1·0	1,489	460	70	⅓ dilution. + ⅓ dilution. –	? +	
10	Ketogenic.	2·0 : 1·0	1,489	540	Probably less than 40	Undiluted. + ½ diluted. –	Not detected.	
11	Ketogenic.	2·26 : 1·0	1,586	450	Probably less than 75	⅓ dilution. + ½ dilution. + ⅓ dilution. –	+	
12	Ketogenic.	2·26 : 1·0	1,586	690	176	⅓ dilution. + ⅓ dilution. –		Still bright and well. No nausea. No change in colour. Not constipated. Tiring of diet.
13	Ketogenic.	2·26 : 1·0	1,586	420	64	⅓ dilution. + ½ dilution. Faintly + ⅓ dilution. –	? +	

[1] + indicates reaction; – indicates no reaction.

TABLE XII.

Showing Results of Estimation of Ketone Bodies in Cyclic Vomiting Syndrome Patient, Number IV.

Day.	Diet for Previous 24 Hours.	Diet Ratio of Ketogenic/Antiketogenic Substances.	Calories of Diet (per 24 Hours).	Urine. (Approximate Amount for 24 Hours.)	Ketone Bodies in Urine. (Milligrammes per 100 Cubic Centimetres.)	Rothera's Test (Urine).[1]	Breath Acetone.	Clinical Notes
1	Ward diet.	1·0:4·0		C.cm. 700	Nil.	−	Not detected.	
2	Ketogenic.	1·3:1·0	1,352	980	Nil.	−	Not detected.	
3	Ketogenic.	2·0:1·0	1,489	540	68	½ dilution. + ¼ dilution. Faintly + ⅛ dilution. −	? +	No change in colour. No nausea. Not constipated. Taking ketogenic diet well.
4	Ketogenic.	2·0:1·0	1,489	830	600	1/64 dilution. + 1/128 dilution. −	Present, but not marked.	No obvious change in condition. No loss of appetite or nausea.
5	Ketogenic.	2·0:1·0	1,489					Clinical condition apparently unaltered.
6	Ketogenic.	2·0:1·0	1,489					Clinical condition apparently unaltered.
7	Ketogenic.	2·26:1·0	1,586	300?	92	½ dilution. + ¼ dilution. Faintly +	Faint.	Some difficulties with diet.

[1] + indicates reaction; − indicates no reaction.

frequent vomiting attacks in childhood, that she now suffers from occasional severe left-sided headaches accompanied by variable visual disturbances (? teichopsia) and that she is also subject to hay fever. The boy's brother and sister both suffer from tram and train sickness. His vomiting attacks occurred at irregular intervals of six to twelve weeks and persisted for twelve to twenty-four hours. For the past year headache had been a prominent feature of many attacks and was sometimes accompanied by a visual disturbance described as "bright flags".

TABLE XIII.

Observation.	Approximate Degree of Ketonuria. (Milligrammes 100 Cubic Centimetres of Urine.)[1]
Attack in May, 1933.	
Specimen of urine passed about twenty hours after the onset	40 to 75
Specimen of urine passed about twenty-eight hours after onset, the vomiting having ceased about six hours earlier. Child looking better and apparently recovering from attack	175 to 250
Attack in November, 1933.	
Specimen of urine passed about seven hours after the onset	Probably less than 15
Specimen of urine passed about eighteen hours after the onset	40 to 75.
Specimen of urine passed about thirty-four hours after the onset. (The vomiting, which continued for approximately twenty-eight hours, having ceased.)	175 to 250
Approximately fifty-one hours after the onset, and nearly twenty-four hours after the cessation of the vomiting. Bright, good colour, and eating well..	75 to 100

[1] These figures were obtained by the application of Rothera's test to varying dilutions of urine, as described in the section dealing with quantitative estimations of ketonuria.

Recently most of the attacks seem to have followed emotional disturbance; for example, attacks have followed school examinations, and a severe attack followed the arrival of police to arrest the father for beating his wife. The results of examining his urine are shown in Table XIV.

TABLE XIV.

Observation.	Approximate Degree of Ketonuria. (Milligrammes per 100 Cubic Centimetres of Urine.)[1]
Attack of cyclic vomiting in November, 1933.	
Specimen of urine passed about six hours after onset	75 to 100.
Specimen of urine passed about eleven hours after onset. Drowsy, pale and collapsed ..	250 to 350.
Specimen of urine passed about six hours after apparent recovery from the attack (approximately twenty-four hours after the onset)..	175 to 250.
Removal of tonsils and post-nasal adenoids, February, 1934.	
Specimen of urine passed shortly after anæsthetic	40 to 75.
Only two or three small, post-anæsthetic vomiting attacks; general condition good.	
Attack of cyclic vomiting in June, 1934.	
Specimen of urine passed about six to ten hours after onset	250 to 350.
Attack of acute bronchitis and otitis media, August, 1934.	
About fourth day of illness temperature 37·2° to 38·3° C. (99° to 101° F.). No vomiting	20 to 30.

[1] These figures were obtained by the application of Rothera's test to varying dilutions of urine, as described in the section dealing with quantitative estimations of ketonuria.

Like the previous patient, this boy, at the height of his artificial ketosis, exhibited a degree of ketonuria (600 milligrammes per 100 cubic centimetres) far in excess of that found during his cyclic vomiting attacks, without any obvious disturbance of health.

It is also interesting to find that this child, who will develop an attack of cyclic vomiting without any obvious precipitant or perhaps as a result of some emotional disturbance, experienced a short anæsthetic and also a mild acute infection, each accompanied by a minor degree of ketonuria, without developing one of his classical attacks.

It will be noted that in both of these children the ketonuria persisted for some hours after the cessation of the vomiting. As would be expected, the persistence of the ketonuria after apparent recovery from an attack was observed in the majority of the cyclic vomiting children, ketones usually being present in the urine for approximately forty-eight hours or more, and rarely for as long as three to five days, after the cessation of the vomiting.

Observations on Ketonuria in Children subject to Cyclic Vomiting Attacks.

Degree of Ketonuria during Attacks of Cyclic Vomiting.

The degree of ketonuria during attacks was found to be extraordinarily variable and, except in prolonged or severe attacks, did not seem to bear a direct relation to the gravity or nature of the disturbance. For example, it was surprising to find less than 30 milligrammes of ketone bodies per 100 cubic centimetres in the urine from prostrated children who might have been vomiting for some time, while the urine of children who had vomited only two or three times and who exhibited very little constitutional disturbance, might contain as much as 200 milligrammes of ketones per 100 cubic centimetres.

Towards the end of an attack of moderate severity or at the end of more than eight to twelve hours' vomiting there seemed to be much less variation in the degree of ketonuria, which was almost invariably found to exceed 50 to 100 milligrammes of ketone bodies per 100 cubic centimetres of urine. It seemed possible that this later and more constant degree of ketonuria was to a large extent a secondary result of the vomiting in contrast to that ketonuria, of such variable intensity, which occurred during the early stages of most attacks and which might be regarded as a primary concomitant of the original, unknown, underlying disturbance.

In a previous section the degree of ketonuria encountered in two children during typical attacks of cyclic vomiting has been contrasted with the degree of ketonuria produced in the same children by means of ketogenic diets. It was found that a degree of ketonuria greater than that encountered during their average attacks of cyclic vomiting could be produced in these children by means of ketogenic diets without precipitating any signs or symptoms suggestive of an attack or even causing any apparent disturbance of health.

Acute Infections.

During the course of the present study several of the children who were prone to attacks of cyclic vomiting suffered from short acute infections. It was particularly interesting to find that no characteristic attacks of cyclic vomiting were produced, although the majority of these acute infections were accompanied by a moderate degree of ketonuria.

I do not mean to deny the fact that acute infections may precipitate attacks of cyclic vomiting, but wish to stress the fact that these susceptible children were able to withstand short acute infections without developing classical attacks.

The following notes from the records of one child are of particular interest in this respect.

P.M., aged five and a half years, afforded a typical example of the cyclic vomiting syndrome. His attacks usually persisted for twenty-four hours or more, occurred at about three to six week intervals, and were without any obvious cause. Specimens of urine collected during the early stages of two attacks had contained approximately 20 to 30 and 40 to 75 milligrammes of ketone bodies per 100 cubic centimetres. During an attack of measles, which was accompanied by acute bronchitis and a temperature of 37·8° to 39·4° C. (100° to 103° F.), this child's urine was found to contain approximately 70 to 100 milligrammes of ketone bodies per 100 cubic centimetres, and yet no vomiting resulted. At a later date he suffered from an acute pharyngitis accompanied by a temperature of 37·2° to 37·8° C. (99° to 100° F.) and a ketonuria (of approximately 20 to 30 milligrammes per 100 cubic centimetres) without exhibiting any signs or symptoms suggestive of an attack.

Anæsthetics.

Many authorities regard general anæsthesia as being especially prone to precipitate an attack of cyclic vomiting in the susceptible child, and yet four of the eighteen children who formed the basis of this present study underwent general anæsthesia with no more than the usual degree of post-anæsthetic nausea and vomiting. Admittedly the periods of anæsthesia were all short and the children were given the extra glucose which has become a pre-anæsthetic routine measure.

I was interested to observe a typical attack of vomiting, in a girl of nine years, which apparently resulted from the emotional stress of admission to hospital, and to find the same child recovering from a general anæsthetic without any more than the usual degree of post-anæsthetic nausea and with only a trace of ketone bodies in her urine.

E.H., aged nine years, had suffered from vomiting attacks at two to six weekly intervals since the age of six years. The attacks were preceded by pallor, irritability and "dark rings" under the eyes, persisted for twenty-four to forty-eight hours and frequently seemed to be precipitated by some undue stress of school work, apprehension or over-exertion. Her mother suffered frequent "bilious attacks" in childhood and has for many years been subject to severe right frontal headaches, accompanied by visual disturbances and sometimes by vomiting.

On admission to hospital for tonsillectomy this child appeared very pale and apprehensive, and within an hour or so was vomiting. The vomiting persisted for approximately thirty-six hours and was accompanied by a moderate degree of ketonuria and prostration.

A week after admission she was subjected to a general anæsthetic for tonsillectomy (without any more prepara-

tion than the usual pre-anæsthetic administration of glucose), after which she exhibited a mild ketonuria but vomited only three or four times.

Another child was subjected to appendicectomy, during what may have been possibly one of his earlier attacks of cyclic vomiting, without any apparent aggravation of his symptoms.

L.O.; a boy of eleven years, had suffered from attacks of vomiting which, from the time he was seven years of age, were sometimes associated with abdominal pain. One sister suffered from bus and tram sickness, and his mother stated that she had been subject to frequent "bilious attacks" in infancy. His attacks occurred approximately every two months, with occasionally longer intervals.

During a possible attack at nine years of age a diagnosis of acute appendicitis was made and immediate appendicectomy was performed. His mother seems certain that there was not an excessive amount of post-anæsthetic vomiting and thinks that the vomiting ceased less than eight hours after the operation.

Presence of Ketonuria between Attacks of the Cyclic Vomiting Syndrome.

On several occasions minor degrees of ketonuria were detected during the very early prodromal stages of an attack, and on two occasions the urine reacted to Rothera's test before any suggestion of an oncoming attack had been noted. In more than 50% of the cases some degree of ketonuria was detected before the child had actually vomited.

With the object of determining whether these children suffered from intermittent ketonuria between their classical attacks, specimens of urine from four children were tested in their homes by Rothera's method over an average period of approximately three months. In three of these children no ketonuria was discovered between attacks, but the fourth child's urine was found to contain some ketones on four occasions, without any obvious reason and without any apparent disturbance of health.

The syndrome of the over-tired child has been described and the fact that an over-tiring day frequently seems to be the precipitant of an attack of cyclic vomiting has been stressed. Both these findings suggest the importance of over-tiredness as a precipitant of attacks. It seems that undue emotional stress or a combination of emotional and physical stress are much more likely to precipitate an attack than excessive physical exertion alone.

With the object of attempting to assess the part played by physical exertion in the production of ketonuria in the child subject to cyclic vomiting, arrangements were made with four of the mothers to test specimens of urine for ketones and to keep notes of their children's condition after any considerable physical exertion. Approximately twenty specimens of urine were tested by Rothera's test without any positive results being obtained, and transient pallor was the only minor change in condition which was noted with any degree of frequency.

Blood Sugar Studies.

A large number of blood sugar estimations have been carried out during ketosis, but the results are somewhat contradictory.

In 1914 Allen[21] reported that no fall in blood sugar takes place in adults, even after prolonged fasting and ketosis; but many of the more recent observers have recorded a definite fall in the blood sugar level of fasting children under these conditions. Possibly the more rapid utilization of the mobilized glucose in the child and the resulting earlier depletion of glycogen reserves may account for this apparent discrepancy.

In children Tallerman[32] noted a high fasting blood sugar during the ketosis of infection, while Ross and Josephs[25] found a slight fall in the blood sugar during ketosis produced by a high fat and low carbohydrate diet. Brown and Graham[34] studied the fasting blood sugar in ten children who were receiving ketogenic diets, but no appreciable fall in the blood sugar during ketosis was noted in these children; while Wylie and Schlesinger[20] found a definite fall in the blood sugar level of children who had been given ketogenic diets.

Ross and Josephs[25] and others have shown that the child's blood sugar falls to a low level (0·04% to 0·06%) at the beginning of an attack of cyclic vomiting and that, as the attack subsides, the blood sugar rises to a normal level. They regard this hypoglycæmia as probably causal.

In direct opposition to these statements are the observations of Salomonsen and Bjelke,[33] who carried out a complete and careful study of the urinary ketones and blood sugar during attacks of cyclic vomiting in a child of five years. After twenty-four hours of vomiting this child's blood sugar was found to be between 0·122% and 0·136%, and after the attack had persisted for more than seventy-two hours and the ketonuria was at its height the blood sugar had not fallen below 0·112%. During a final period of twenty-four hours, when the child appeared to be recovering, his blood sugar fell to 0·077%. Graham and Morris[26] also observed a child during an actual attack of cyclic vomiting, but did not find an abnormally low blood sugar and concluded that hypoglycæmia was not a causal factor.

Hilliger studied a child subject to cyclic vomiting attacks and found that if all carbohydrates were withdrawn from the diet a rapid fall in blood sugar, a marked ketosis and usually a classical attack of vomiting were precipitated. Salomonsen[33] and others found that hypoglycæmia and ketosis resulted from a similar diet in both normal and cyclic vomiting children, but these disturbances were not accompanied by vomiting in either group.

Talbot, Shaw and Moriarty[24] have been able to demonstrate the fact that during starvation children may not exhibit any of the so-called hypoglycæmic symptoms, even though their blood sugar has fallen to extremely low levels. These observers studied a series of epileptic children during periods of starvation and found a marked hypoglycæmia (even as low as 0·038%) by the third day of the fast. But, despite this chemical evidence of hypoglycæmia, clinical symptoms were absent, and so long as a liberal supply of water was given there were few, if any, subjective symptoms. It was found that if the fluid intake was diminished the child became flushed, anxious, and complained of abdominal pain.

Although it is difficult to draw any definite conclusions from these conflicting opinions, it would seem that, although hypoglycæmia may occur during cyclic vomiting attacks, it is not a constant accompaniment and is not to be regarded as a causal factor, but possibly as a secondary result of the unknown primary basic disturbance. If this last supposition is correct, then we may assume that the hypoglycæmia, the ketonuria and possibly the acidosis which may be found during an attack of cyclic vomiting, are all merely secondary results or concomitants of the unknown basic disturbance.

During the present study a small series of blood sugar estimations was carried out by a modification of the Folin and Wu method,[1] and the results have been recorded in the accompanying table. (See Table XV.)

TABLE XV.

Blood Sugar Estimations.

(The sugar is stated as milligrammes per 100 cubic centimetres.)

Observation.	Ward Diet. (Not Ketosed.)	Ketogenic Dict. (Ketosed.)	Fall in Blood Sugar.
1. Normal child	89	76	13
2. Normal child	103	99	4
3. Normal child	92	88	4
4. Child subject to cyclic vomiting syndrome	87	74	13
5. Child subject to cyclic vomiting syndrome	98	82	16
6. Child subject to cyclic vomiting syndrome	87	80	7
7. Child subject to cyclic vomiting syndrome	92	87	5

This series of blood sugar estimations is obviously too small and incomplete to permit of any conclusion, but it may be of interest to note that the blood sugar levels were definitely lower during artificial ketosis in both groups of children.

Response of Blood Sugar to Subcutaneous Injections of Adrenaline.

The rapid rise of the blood sugar after a subcutaneous injection of adrenaline has been shown to be the result of accelerated liver glycogenolysis.[37] Bray[37] states that in children, after an injection of adrenaline, the normal curve usually rises thirty to forty milligrammes above the fasting level within the first half hour and then declines slightly to the hour point, and that in liver dysfunction the curve is frequently delayed and shows only a very slight rise.

With the object of obtaining some estimate of the glycogenolytic function of the liver, the response of the blood sugar to subcutaneous injections of adrenaline was followed in two normal children and four children subject to attacks of cyclic vomiting: (*a*) before the institution of the ketogenic diet, (*b*) at the approximate peak of the induced ketosis.

The amount of adrenaline (adrenaline chloride, 1 in 1,000) for subcutaneous injections was based on the dosages suggested by Mitchell[38] and regarded as being the smallest quantities of this drug which would cause a rise in the blood sugar. (See Table XVI.)

TABLE XVI.

Age of Child.	Amount of Adrenaline Chloride, one in 1,000.
1 year	0·06 cubic centimetre (1 minim).
2 years	0·12 cubic centimetre (2 minims).
3, 4, 5, 6 and 7 years	0·18 cubic centimetre (3 minims).
8 years	0·24 cubic centimetre (4 minims).
9, 10 and 11 years	0·30 cubic centimetre (5 minims).
12 years	0·36 cubic centimetre (6 minims).

The blood sugar was estimated before and at intervals of 15, 30 and 60 minutes after the subcutaneous injection of the appropriate amount of adrenaline. The results of these investigations have been embodied in the accompanying graphs.

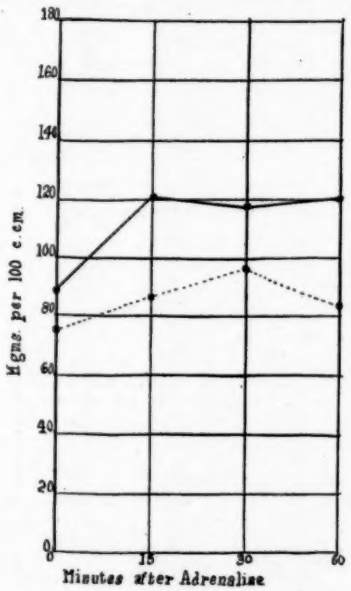

FIGURE I.[1]

Showing results of blood sugar estimation after injections of adrenaline in normal child number 1.

All the children of both groups showed an approximate normal response in their sugar curves after the adrenaline, both during and before ketosis.

Apart from the lower level of the blood sugar found before the injection of adrenaline in the children with ketosis, there was very little difference between the sugar curves, in response to adrenaline, of the children with ketosis and those without. In the cases of both the normal children and those subject to cyclic vomiting the curves were a little flatter during ketosis than under normal conditions, but the average maximum elevation of the blood sugar after an injection of adrenaline was approxi-

[1] Method of Folin and Wu as adapted by Wallis and others for use with 0·1 cubic centimetre of blood.

[1] In all the graphs the dotted line indicates the ketosis curve; the continuous line indicates the curve when ketosis is not present.

mately the same (that is, 34 milligrammes in the children without ketosis and 36 milligrammes in those with ketosis). Possibly the slightly flatter curve exhibited by the child with ketosis may be explained by depleted liver glycogen stores rather than as a result of the ketosis *per se*.

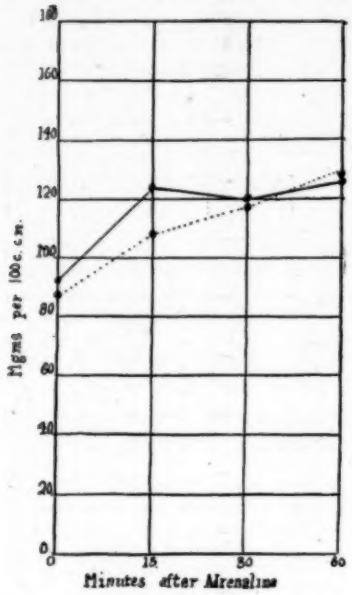

FIGURE II.

Showing results of blood sugar estimation after injections of adrenaline in normal child number 2.

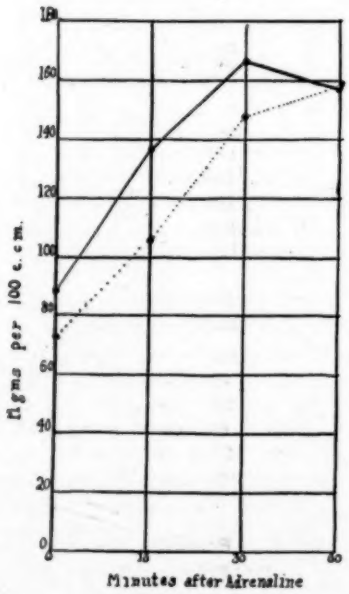

FIGURE III.

Showing results of blood sugar estimation after injections of adrenaline in cyclic vomiting patient number 1.

Von Gierke's Glycogen Accumulation Disease.

During the early months of this study my attention was drawn to von Gierke's glycogen accumulation disease, a condition regarded by most authorities as a disturbance of the mechanism of glycogen mobilization which is probably congenital in origin and frequently subsides at or before puberty. The outstanding features of this syndrome are: gross enlargement of the liver and possibly of other organs, persistent or almost persistent ketonuria, hypoglycæmia and a failure of the blood sugar level to respond to hypodermic injections of adrenaline. Many of these children exhibit some signs suggestive of an endocrine disturbance (possibly mainly hypophyseal) and there is usually some retardation of growth. In some of the children there is a history of vomiting or epileptiform attacks during infancy, but such attacks rarely persist.

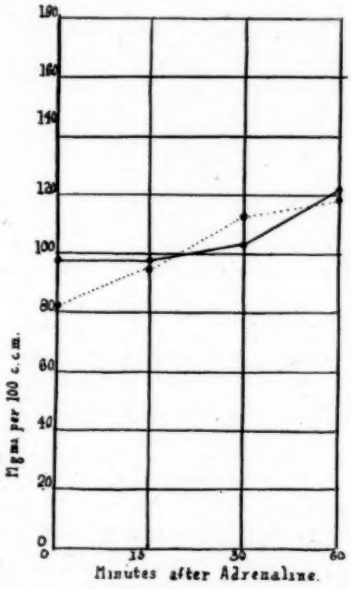

FIGURE IV.

Showing results of blood sugar estimation after injections of adrenaline in cyclic vomiting patient number 2.

It seemed possible that a similar, but acute and temporary, disturbance of the glycogen mobilization mechanism might be responsible for the vomiting, prostration and ketonuria of the cyclic vomiting attack. For this reason it was thought that a brief comparison of the main features of these two syndromes might possibly throw some light on the ætiology of the cyclic vomiting attack.

Possibly hypoglycæmia is common to both syndromes, although its presence in the child susceptible to cyclic vomiting is denied by some authorities. Although the literature contains a number of examples of enlargement of the liver associated with attacks of cyclic vomiting, the gross enlargement which is an early and constant sign of von Gierke's disease was not encountered in any of the eighteen

cyclic vomiting children of the present study, nor was there any obvious increase in the size of this organ during or immediately after attacks of cyclic vomiting. However, it must be regarded as unlikely that if a brief and temporary disturbance of glycogen mobilization was responsible for the attacks of cyclic vomiting, it would necessarily result in any gross enlargement of the liver.

The children subject to attacks of cyclic vomiting showed a normal rise in their blood sugar level after injections of adrenaline, both before ketosis and at the height of ketosis; while the absence of any or at least of an adequate rise of the blood sugar after an injection of adrenaline is a characteristic feature of von Gierke's disease. It would have been particularly interesting to have assessed the response of the blood sugar level to an injection of adrenaline during an actual attack of cyclic vomiting, for the finding of a normal response in the cyclic vomiting children at the height of a ketosis does not establish the fact that these children would show a normal blood sugar response to adrenaline during an attack of cyclic vomiting. Unfortunately such an investigation was found to be impracticable.

Although many of the children suffering from von Gierke's disease exhibit some signs of endocrine imbalance, there was no obvious evidence of such disturbances in the eighteen cyclic vomiting children under observation.

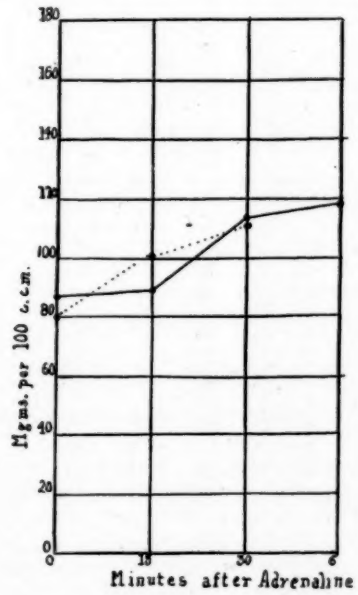

FIGURE V.

Showing results of blood sugar estimation after injections of adrenaline in cyclic vomiting patient number 3.

It seems probable that many of the children who suffer from glycogen accumulation disease are able to readjust their metabolism at some stage during adolescence, and apparently the metabolic disturbance responsible for the cyclic vomiting attack is adjusted at about the same age, for it is widely recognized that such attacks are rarely encountered in children over fifteen years of age (although in a certain number of cases the vomiting attack seems to be replaced by migraine).

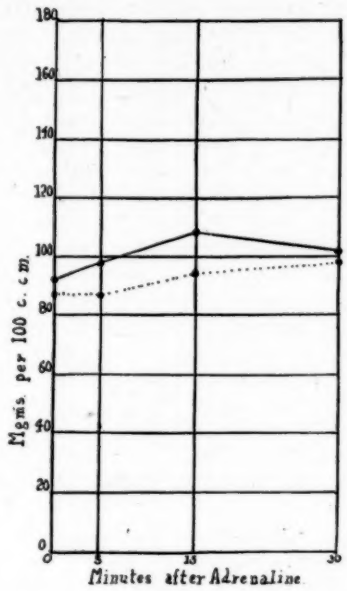

FIGURE VI.

Showing results of blood sugar estimation after injections of adrenaline in cyclic vomiting patient number 4.

From the above discussion it may be assumed that there is no definite relation between the metabolic disturbances responsible for glycogen accumulation disease and the cyclic vomiting syndrome, but it seems that the subject is one worthy of further thought and investigation.

OBSERVATIONS ON CERTAIN ASPECTS OF THE TREATMENT OF CYCLIC VOMITING.

The following brief notes and suggestions are based to a large extent on my own personal impressions of certain aspects of this problem and are not intended to represent a general discussion of the treatment of cyclic vomiting. The data presented are obviously inadequate for any definite conclusions.

Prophylaxis.

Prophylactic Dietary.

A. A. Osman,[40] describing his observations on a group of thirty children subject to cyclic vomiting attacks, and also his experiences with a larger group, made the following statements:

After some months it was noticed that, though new cases of cyclic vomiting were seen, none of those already under observation had further attacks, though no special treat-

ment had been undertaken. In order to secure regular attendance, malt extract had been given to all cases as a placebo; but on further examination it was found that it was the malt which was preventing the occurrence of the attacks . . . . Thereafter all children with this complaint were given extra sugar as a routine, with the result that in the great majority of over two hundred cases treated the attacks have been entirely prevented.

My own experiences with a high carbohydrate and low fat diet as an unaided prophylactic measure have been much less satisfactory than those described by Osman.

When cyclic vomiting was assumed to be due to a ketosis resulting from an arrest of the complete combustion of fats, this practice of restricting the amount of fat and increasing the amount of carbohydrate in the child's diet seemed a most reasonable form of prophylaxis.

It has been shown that these children can mobilize their liver glycogen under normal conditions and also during artificial ketosis (see "Response of Blood Sugar to Adrenaline"), but little is known of their ability to mobilize glycogen during an actual attack. Even if, as has been suggested, the underlying disturbance is the result of a sudden failure of glycogen mobilization, it seems questionable whether a long-continued high carbohydrate and low fat diet will be of any help in this respect. Further, it has been established that the fat metabolism of these children is not disturbed between attacks and from the previous discussion and findings it seems obvious that the cyclic vomiting attacks are not produced by the ketosis *per se*.

In view of these statements there seems to be little or no reason for following these dietetic restrictions during the weeks or months which may intervene between attacks.

Because such a diet, of excessive carbohydrate and extremely limited fat, is obviously unsatisfactory for the growing child, and because of the lack of any sound reasons for this prophylactic form of dieting, it was decided to observe the response of two groups of children susceptible to cyclic vomiting to (i) a strict prophylactic diet of this nature, (ii) an ordinary unrestricted diet with adequate fat.

With this object the mothers of six susceptible children were instructed to restrict severely the amount of fat and to give as much carbohydrate as their children would willingly take. The mothers of a second group of eight children were advised to give an ordinary unrestricted diet, and the importance of sufficient fat was emphasized to each of these mothers. The mothers of both groups were advised to give extra carbohydrate (in the form of sweetened orange drink, barley sugar or ordinary cane sugar) if their children showed any signs of an impending attack.

These two groups of children were observed over periods varying from seven to fifteen months (the average period being about nine to ten months) and it was hoped that it would be possible to give some figures contrasting the results.[1]

Although this accurate comparison proved impossible, it seemed certain that there was no obvious difference in the results obtained under these two different *régimes*, and that the group whose fats had been carefully restricted did not show any better response than those of the other group.

These observations and comments are not meant to refer in any way to the treatment of an actual attack, when glucose and other carbohydrates are regarded as the ideal diet.

Avoidance of Nervous and Physical Exhaustion.

Despite our ignorance of the underlying metabolic disturbances, we may be able to afford these children some help by seeking for and controlling or eliminating those factors which seem to precipitate an attack. It is even conceivable that each attack of cyclic vomiting predisposes to another, and that any measures which will increase the interval may help to raise the threshold so that a greater stimulus will be necessary to produce an attack.

While I was observing the present group of children I noticed that the great majority of attacks seemed to be precipitated by undue emotional stress or a combination of undue emotional and physical stress. Numerous observations during the present study have suggested the importance of these factors as possible precipitants of attacks in the susceptible child. To cite some of these observations:

1. As the susceptible child is usually highly sensitive and his parents are frequently of a nervous type, he is probably particularly prone to emotional disturbances. It is suggested that the frequent repetition of these emotional disturbances in such a child, whose metabolism seems to be relatively unstable, may possibly increase this metabolic instability until finally a classical attack results.

2. The majority of the attacks began at the end of a day which had been more tiring than usual and which had frequently included some undue excitement, anxiety or apprehension. The suggestion that some particular emotional stress appeared to have precipitated the attack was a common feature of many of the histories.

As interesting evidence of the probable significance of emotional disturbances in the precipitation of attacks three cases may be instanced:

A.H., who frequently develops an attack of cyclic vomiting after some emotional disturbance, experienced a short anæsthetic and also a mild acute infection without developing an attack. (For details see above.)

[1] Unfortunately it was soon realized that it was extraordinarily difficult to assess the results of treatment in a condition such as this, because one was largely dependent on verbal reports from the mother as to the gravity and frequency of the attacks. These maternal statements were often found to be very variable, and it was felt that the apparent prolongation of the free interval and the diminution of the severity of the attacks which was reported in some of the children, after only two or three months of observation, might be explained sometimes by a previous exaggeration of their frequency and severity.

E.H. suffered a typical attack of vomiting apparently as the result of the emotional stress of her admission to hospital and yet vomited only two or three times after an ether anæsthetic for tonsillectomy. (For details see above.)

M.G., a girl of five years, apparently had suffered from classical attacks of cyclic vomiting since two years of age. The attacks occurred every two to three months and persisted for two to five days. Her maternal grandmother had suffered from asthma, her mother from (?) migrainous attacks and frequent nightmares, and her father was receiving treatment for Ménière's disease. This child had been most carefully examined, investigated, and treated by three or more physicians, who all agreed that they could find no reason for her attacks. Her nurse had meticulously restricted the amount of fat in the child's diet and had given an abundant supply of carbohydrates and glucose over a period of more than a year, and yet there had been no diminution in the severity or frequency of the attacks. Emotional disturbance seemed to be the main precipitating factor in this case. The child was frequently found to be pale and ketosed after spending a day with her family (in the absence of her placid nurse), and almost every attack was regarded as the immediate sequel of some obvious emotional upset.

3. The clinical syndrome of the over-tired child, which usually develops after a day of undue emotional or physical stress, has many features in common with the early stages of a cyclic vomiting attack. Further, like the cyclic vomiting attacks, these attacks of over-tiredness usually occur in the same highly sensitive type of children whose parents are frequently over-anxious and unduly nervous.

4. It has been observed that the presence of an over-anxious and overwrought mother frequently prolongs an attack and that the arrival of a placid, confident nurse often brings relief. The frequency and severity of the attacks during a *régime* of parental nervousness and apprehension and the prolongation of the intervals and diminution of the gravity of the attacks when the child is placed under the complete charge of a placid nurse or guardian, have been obvious features of four of the histories of the present series of children.

In view of the above suggestions it was thought to be most advisable that these children should be shielded against over-excitement, undue emotional disturbances and over-tiring physical efforts.

It was soon found in practice that if these patients were protected as much as possible from such stresses there was a definite diminution in the number of their attacks. It was also found that a short but complete rest, and possibly some nerve sedatives, before and/or after any unavoidable stresses of this nature, seemed to be helpful in aborting or diminishing possible attacks.

The Treatment of an Attack.

A positive result to the sodium nitroprusside test was found during the prodromal stages in approximately 50% of the susceptible children, and in some of these children was present before any prodromal manifestations. In children belonging to this group it seemed that such a finding would either suggest that an attack was imminent or would emphasize the significance of accompanying minor prodromal signs and symptoms and therefore prove of value as an indication for rest, glucose and possibly nervous sedatives.

Once it had been established that a child usually exhibited this early ketonuria there was little difficulty in persuading the mother to carry out regular sodium nitroprusside tests of the urine, particularly if the possibility of avoiding an attack was emphasized. This method of anticipating an oncoming attack was used with some success in four children of the present series and with almost complete success in the case of a boy of eight years.

Rest.—Once an attack is threatening or has actually commenced, one of the first essentials of successful treatment is complete physical and mental rest. Not only is rest in bed, preferably in a darkened room, essential, but in many cases it is advisable that the child should be isolated from an over-anxious parent, who may be replaced by a calm and confident nurse or attendant. It was frequently found that the arrival of a capable nurse and the dismissal of a distressed mother from the sick-room resulted in a rapid abatement of the vomiting and a marked improvement in the child's general condition.

Glucose.—It is usually recognized that extra glucose or other carbohydrate is of assistance in the treatment of the actual attack and in the aborting of some threatened attacks. Originally the success of glucose therapy was attributed to the prevention or reduction of ketosis, but since it seems unlikely that this explanation is still wholly acceptable, it is necessary to find some other reason for its therapeutic value. Reginald Miller,[23] who regards intestinal toxæmia as an important factor in the causation of cyclic vomiting attacks, has suggested that the value of glucose probably lies in its power of rendering the liver less susceptible to toxins.

Glucose Enemata.—Despite the clinical and experimental evidence against the theory of free absorption of glucose from the colon,[1] and although it is rarely possible to give a child more than a small amount of glucose by this route, I still hold the definite impression that those children who cannot retain any glucose or other carbohydrate by mouth are benefited by glucose enemata.

As it seems unlikely that much of the glucose is absorbed from the bowel, I would suggest that it may be the absorption of the saline solution and the aperient action of the enema which are responsible for the improvement that these children exhibit after the administration of glucose and saline *per rectum*.

Nerve Sedatives.—Three children in whom undue emotional disturbances seemed to be an obvious

[1] As regards the absorption of glucose from the bowel, Maxwell[29] states that 50 to 80 grammes of glucose administered *per rectum* in saline solution to fasting men caused a mean rise of blood sugar of 0·008%, while the same quantity of glucose given by mouth produced a mean rise of 0·085%, that is an increase more than ten times as great as when the glucose was given rectally. Maxwell also describes animal experimentation work carried out by McNealy and Willens, which showed that there was little or no absorption of glucose from the colon in dogs.

precipitant of attacks, were given small doses of "Luminal" or sodium phenobarbital regularly over periods of several months. Unfortunately these children did not show any definite improvement as a result of this treatment; possibly with more prolonged treatment or larger doses some diminution in the frequency or severity of the attacks might have been attained. Larger doses of "Luminal" or sodium phenobarbital given with the glucose at the onset or during the early prodromal stages of an attack seemed to be a help in some attacks.

During the past year I have tried the effect of chloral hydrate, given *per rectum*, to three children during the early stages of their attacks, and feel that this is a valuable adjuvant to rest and glucose in certain cases. Some difficulty was encountered in assessing a satisfactory dose, and occasionally the children failed to retain the unnecessarily large amounts of saline solution which were given at first.

It was arranged with two of the more capable mothers that they should give their children a specified dose of chloral hydrate rectally whenever rest and glucose failed to abort an attack.

These two children were six and eight years of age and weighed approximately 18·9 and 24·3 kilograms (42 and 54 pounds) respectively. After some adjustment of the dose of the drug and of the size of the enema it was found that 1·2 to 1·5 grammes (20 to 25 grains) of chloral hydrate in 60 or 90 cubic centimetres, that is, two or three ounces, of normal saline solution, given *per rectum*, usually produced a short sleep of one-half to three hours. Both mothers were satisfied that this treatment greatly diminished the severity of the attacks, and in the case of the elder child two recent attacks seem to have been aborted by the treatment.

If this treatment could be carried out in the early stages of an attack by a trained nurse or in hospital it might be possible to produce a sleep of six hours or more by giving a slightly larger dose of chloral hydrate and repeating this in four hours or less. A sound sleep of this duration and the consequent absence of vomiting should afford invaluable assistance in the early stages of an attack and might be sufficient to abort the vomiting. It is not suggested that any treatment of this kind should be employed during the later stages of an attack, nor is it felt that this procedure is a safe or satisfactory one in the hands of the less capable mother.

SUMMARY AND CONCLUSIONS.

1. An investigation of the incidence of ketonuria among 685 admissions to the wards of the Royal Alexandra Hospital for Children revealed: (i) a general incidence of 46%, (ii) an incidence of 57% in the febrile and of 30% in the afebrile children, (iii) a lower incidence in the group of children under three years of age than in those over this age.

2. Attempts to assess the part played by either emotional disturbances or marked physical exertion in the production of ketonuria proved inconclusive but suggested that these stresses, unless unduly severe or prolonged, would be unlikely to produce ketonuria in the normal child.

3. As the result of a clinical study of eighteen children subject to cyclic vomiting attacks, the majority of whom were observed over a period of approximately two years, the following findings have been recorded:

A. Cyclic vomiting was found to be much more common among the out-patient class of children than is usually realized.

B. There was frequently a family history of similar attacks (44% of cases), tram, train or car sickness (33% of cases), migraine (26% of cases), asthma or hay fever (30% of cases).

C. The majority of the children were alert, easily excitable, and tended to live on an "all-out" principle.

D. Defects of stance and signs of vasomotor instability were frequently noted.

E. None of these children exhibited signs of patent endocrine disturbance.

F. Neither gross enlargement of the liver nor obvious jaundice was detected between or during any of the attacks.

G. The first attack usually occurred between three and eight years of age, and the intervals between attacks were found to be extremely variable. The majority of the attacks commenced during the night or the latter part of the day.

H. It seemed that "the attack", as observed in this series of children, might be artificially subdivided into three stages: (i) A period of excitability and excessive energy—a common but not a constant finding. (ii) A stage of pallor and languidness, which was often accompanied by headache and sometimes by a surprising degree of prostration. (iii) A stage of nausea and vomiting, which varied greatly in degree and duration.

I. The dramatic and sudden recovery from even prolonged vomiting proved a striking feature of many attacks and seemed to be independent of the type of treatment instituted.

J. The degree of ketonuria encountered during an attack frequently failed to bear any direct relation to the gravity of the attack. Towards the end of an attack of moderate severity or after more than eight hours' vomiting there seemed to be much less variation in the degree of ketonuria, and it has been suggested that this later and more constant degree of ketonuria may be in part a secondary result of the vomiting, in contrast to that ketonuria of such variable intensity which occurred during the earlier stages of most attacks and which might be regarded as a concomitant of the primary underlying metabolic or nervous disturbance. In more than 50% of the attacks ketone bodies were discovered in the urine before the vomiting commenced, and occasionally ketonuria was found between the attacks.

K. In a small group of these susceptible children it was observed that mild acute infections and short anæsthetics did not precipitate attacks.

L. Many observations and reports during the present study have suggested the possibility that undue emotional disturbance or undue emotional and physical stress may aggravate or precipitate the underlying metabolic disturbance in the susceptible child. Further, it has been interesting to note that many of the children of the present series have evidenced undue nervous excitability and possibly excessive energy as early prodromata of attacks.

4. In the course of practice observations of a minor disturbance of health evidenced by a certain type of child have suggested that this disturbance might be defined as the clinical picture of the overtired child. The close similarity between this condition and the prodromal stages of a cyclic vomiting attack has been emphasized. This syndrome of overtiredness has many features in common with the early stages of a cyclic vomiting attack and usually occurs in the same highly sensitive type of child.

5. After some practical investigations and some slight modifications, Nanavutty's modification of Van Slyke's method was adopted for the quantitative estimation of ketone bodies in the urine of the children subjected to artificial ketogenesis.

6. The results of clinical observation and of quantitative estimations of the ketone bodies in the urine of four normal children and four cyclic vomiting children during periods of artificial ketogenesis (by means of ketogenic diets) might be summarized as follows:

A. The threshold for ketogenesis (produced by means of ketogenic diets) seemed to be approximately the same in both groups of children, while the resultant degree of ketonuria was possibly a little more intense in the child subject to cyclic vomiting attacks.

B. Gross ketonuria (even as high as 600 to 700 milligrammes of ketone bodies per 100 cubic centimetres of urine) was produced in both the normal and the cyclic vomiting children, but was not accompanied in either group by headache, vomiting, pallor or any obvious disturbance of health. No obvious change in the appearance of the stools was noticed during this artificial ketosis.

C. The ease with which the cyclic vomiting children, whose recent diet had usually consisted of a minimum of fat and a maximum of carbohydrate, were able to take these ketogenic diets and tolerate the resultant ketosis seemed worthy of particular emphasis. This artificial ketosis, even when intense, was not accompanied by the pallor, headache, nausea or vomiting which has been regarded by some authorities as the clinical result or accompaniment of ketosis in these children.

D. Occasionally this artificial ketogenesis resulted in a degree of ketonuria which was much higher than that exhibited by the same child during an apparently classical attack of cyclic vomiting.

E. In both groups of children no obvious increase in the urinary output was noted even when the ketone bodies exceeded 100 milligrammes per 100 cubic centimetres of urine.

F. The breath acetone was found to be a surprisingly variable and unreliable sign of ketosis.

7. Apparently ketosis *per se* is not the cause of the cyclic vomiting attack, but is probably a concomitant of the unknown underlying disturbance. Further, it seems that the ketosis is not the result of the nausea and vomiting, although it may be aggravated by them.

8. A simple method for the approximate quantitative assessment of degrees of ketonuria has been proposed. It was thought that this test afforded a rapid and relatively efficient means of defining and comparing varying degrees of ketonuria.

9. Spontaneous hypoglycæmia has been regarded as the cause of cyclic vomiting attacks by some workers, but other observers have shown that hypoglycæmia is not a constant accompaniment of the attack and that there is little evidence to support it as a causal factor. But it would seem that attacks of spontaneous hypoglycæmia in childhood may closely simulate cyclic vomiting, and it is tentatively suggested that theoretically such attacks will respond to the early injection of adrenaline. Unfortunately no practical investigation of this problem has been carried out.

10. A small series of blood sugar estimations was carried out on the blood of normal and cyclic vomiting children, with the following results:

A. The blood sugar levels were found to be slightly lower in both groups of children during ketosis.

B. In both the normal and the cyclic vomiting children the blood sugar level showed a normal response to the subcutaneous injection of a small dose of adrenaline, both before and during ketosis; but during ketosis the curve was slightly flatter in both groups. This would suggest that the child subject to cyclic vomiting can mobilize glycogen not only when there is no ketosis, but also at the height of an artificially induced ketosis.

11. Von Gierke's glycogen accumulation disease and the cyclic vomiting syndrome have been briefly compared and the doubtful possibility that a similar but acute and temporary disturbance of glycogen mobilization may be responsible for the cyclic vomiting attack has been mooted.

12. Practical experiences of certain aspects of the prophylaxis and treatment of cyclic vomiting have been discussed.

A. It has been pointed out that there does not seem to be any sound reason for a prolonged prophylactic dietary of excessive carbohydrates and carefully restricted fats and that such a diet is obviously unsatisfactory for these growing children. During the present study personal impressions of prophylactic dietaries given to two groups of cyclic vomiting children supported the fact that the group whose fats were carefully restricted and whose diet consisted mainly of carbohydrates, did not show any better response than those children who were given adequate fat and an ordinary amount of carbohydrate.

B. The above statements are concerned only with the question of prolonged prophylactic dietaries for these children and are not meant to apply to the problem of diet during the actual attack or its threatening stages.

C. In a previous section attention has been drawn to the importance of undue emotional stress or a combination of undue emotional and physical stress as possible precipitants of attacks in susceptible children. It was my impression that if these patients were protected as much as possible from such stresses there was a definite diminution in the number of their attacks. Further, a short but complete rest, and possibly some nerve sedatives before and/or after any unavoidable stresses of this nature seemed to be helpful in aborting or diminishing possible attacks.

D. The possible value of the regular use of sodium nitroprusside tests as a means of anticipating attacks in some of the susceptible children has been mentioned.

E. Some experiences with nerve sedatives and the possible value of chloral hydrate (given *per rectum*) have been briefly discussed.

ACKNOWLEDGEMENTS.

I wish to thank Professor G. C. Lambie for arranging laboratory facilities and for suggesting certain aspects of this work; Dr. Edgar Stephen for allowing me to admit patients to hospital for investigation; Dr. Canny for much practical help and advice in the matter of the quantitative estimations of ketones; and Dr. Phyllis Anderson, Dr. Ratner, Miss Palmer, Sister Bush and Sister Munro for their assistance with various portions of this study.

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VITAMIN *C* IN THE AUSTRALIAN FAUNA.

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VITAMIN *C* staining tests using acetic acid-silver nitrate have been carried out on selected organs of certain members of the Australian mammalian fauna.

In the echidna (Monotremata) the adrenal, thyreoid, anterior pituitary, testis, liver and crural gland were examined microscopically after preliminary treatment with the acid-silver nitrate mixture. The adrenal glands of the short-headed flying phalanger (*Petaurus breviceps*) and of the short-tailed Western Australian wallaby (*Setonyx brachyurus*) were also investigated in the same way. The three animals were dispatched with either ether or chloroform.

The Echidna.

The adrenal gland of the echidna showed a blackening of both cortical and medullary tissues, although the cortical tissue stained with greater intensity. In the cortical tissue the vitamin took the form of a few large granules in the cell with a few small granules scattered between them. In many cases the large granules were clumped about the nucleus. In the medullary tissue the granules were much finer and did not exhibit this perinuclear condensation.

The anterior pituitary gland did not stain with quite the same intensity as the adrenal gland. The chromophile cells contained the greatest number of granules; the chromophobe cells possessed only a few small granules.

The liver did not stain with the intensity customary to most mammals and the cells contained relatively few granules, which showed no signs of perinuclear aggregation.

The thyreoid did not blacken at all in the reagent, and a few of the cells only showed one or two very small black granules.

The crural gland, which is capable of great seasonal variation in size, was found to stain grey with the reagent, and the cells on microscopic examination were found to contain a number of granules. The cells of the acini composing the gland exhibited practically no granules in the distal cytoplasm, but in the proximal cytoplasm and around the nucleus a number of small granules could be seen; some of them were coalesced to form rodlets or masses. Very few granules were observable in the interacinar tissue.

In the testis a few granules were seen in the germ cells. The greatest concentration, however, was seen in the interstitial cells. The form of the vitamin in these cells was that of fine granules.

The adrenal glands of *Petaurus breviceps* and *Setonyx brachyurus* were both found to stain intensely with the vitamin *C* reagent. Both these animals were dispatched with ether; it is therefore significant that in each the medulla stained with a greater intensity than the cortex.(1) The vitamin in both cortex and medulla was in the form of small granules which did not show any pronounced perinuclear condensation. In some cells an aggregation of the vitamin *C* granules around the lipoid droplets could be observed.

It is of considerable interest that the distribution of vitamin *C* in the organs of the echidna is the same as that of higher mammals, and points to a

similarity of function of the vitamin in the lowest and highest members of the mammalia.

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Reports of Cases.

A CASE OF VARICOSE CORONARY SINUS.[1]

By KEMPSON MADDOX, M.D., M.R.C.P.,

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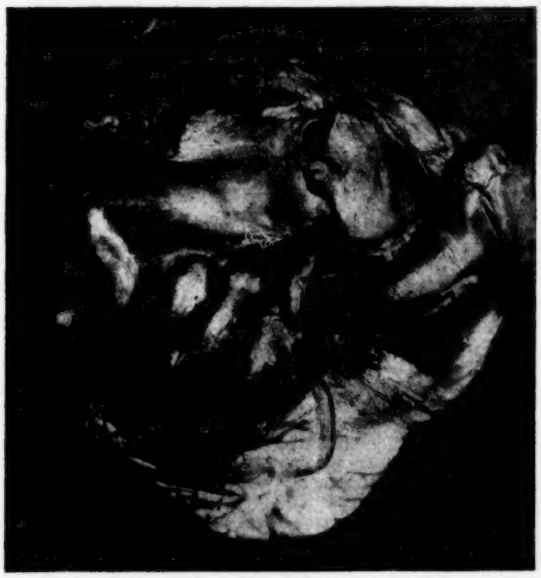
THE patient was an elderly woman, admitted to one of the wards of a London hospital in October, 1934. She appeared clinically to be suffering from congestive cardiac failure, with its usual accompaniments of œdema, cyanosis, dilated veins *et cetera*. No special cardiological investigations were undertaken, as she was too ill. She failed to respond to treatment and died a few days after admission.

On opening the thorax at autopsy the heart was found to be encircled by tubular coils resembling the small intestines in their size and convolutions, but actually they represented an enormously dilated and varicosed coronary sinus. The lumen of the sinus was as large as that of



the aorta. No *ante mortem* clotting had occurred. The openings of the sinus were widely patent. The condition was considered to be congenital. No varicosities were discovered elsewhere. The increase of intraauricular pressure coincident with the onset of cardiac failure would naturally aggravate the dilatation. The condition is shown in the accompanying illustrations.

[1] Illustrations of this condition were shown at a meeting of the New South Wales Branch of the British Medical Association on May 23, 1935.

The alteration in the cardiac contour on fluoroscopy would be striking, but readily mistaken for an aneurysm of the heart wall. It would be impossible to recognize the abnormality by any other means.

I have never heard or read of the condition before and would be interested to hear whether any reader has ever seen it, even in a minor degree.

I am indebted to Dr. N. Matheson, of London, for the opportunity of seeing the specimen and for the photographs.

Reviews.

A HANDBOOK OF GYNÆCOLOGY.

THE third edition of "A Handbook of Gynæcology", by Bethel Solomons, has recently been published.[1] In the preface to the first edition Solomons states that the book was based on lectures delivered to students. The author's aim was to produce a small book, as concise as possible, to aid students in their practical work, and at the same time one which would be useful to general practitioners in their practice. The same principle has been applied to this edition.

By the demand for a third edition it is evident that the general practitioner and the student have found the book useful. In this edition each chapter has been revised; hormone therapy has been condensed as much as possible, the chapter on sterility has been largely rewritten, and Mr. Oliver Chance has contributed an article on radium and X rays.

As a handbook for students and as an introduction to gynæcology the book should prove very useful. The information is well and concisely set out and the essential

[1] "A Handbook of Gynæcology for the Student and General Practitioner", by B. Solomons, B.A., M.D., F.R.C.P.I., F.C.O.G., M.R.I.A.; Third Edition; 1934. London: Baillière, Tindall and Cox. Demy 8vo., pp. 382, with illustrations. Price: 15s. net.

points are clearly explained. The book is an easy one to read and is well printed. The teaching for the most part is on generally accepted lines, and much can be learned from perusing it. We can thus recommend the book as a suitable one for those for whom it has been designed. At the same time there are certain criticisms which we would make. For example, under speculum examination the only varieties mentioned and illustrated are the Neugebauer, which the author advocates, and Fergusson's. We think that the Cusco type of bivalve speculum, a most useful instrument, might in addition be mentioned and illustrated.

Regarding pyosalpinx, in the author's clinic the sedimentation test is used as a routine measure for diagnostic purposes, but in the treatment of pyosalpinx the author states that: "It is supposed by some authorities that it is safe to remove or resect pus tubes immediately or after six to twelve months. We prefer to wait for two years for the pus to become sterile." Surely by use of the sedimentation test information can be obtained which will allow operation to be performed much sooner. It is often a considerable hardship for persons in poor circumstances to have to put up with ill-health for such a prolonged period when it has been shown that a posterior colpotomy followed by section at a later date can be safely performed.

No mention is made of the troublesome discharge associated with the *Trichomonas vaginalis*. Recent work has shown that this condition is present far more frequently than is commonly supposed, and that it is difficult to cure with ordinary methods.

In the investigation of patients with sterility Rubin's test is always used in the author's clinic, and he states that this test can be done easily in the consulting room. We consider that if this test is carried out by the general practitioner as a routine measure in his consulting room much harm can and will be done. Experience has shown that a very careful selection of cases must be made, and we doubt whether a recently qualified practitioner possesses the necessary diagnostic skill to avoid making mistakes in the diagnosis of pelvic ailments. Tubal inflammation going on to pyosalpinx has followed this simple procedure in even good out-patient clinics.

Many of the illustrations are good, but some, notably those depicting total hysterectomy, we think could be improved.

SUICIDE.

IN view of the fact that the statistics regarding attempts at suicide, successful or abortive, are queerly constant in all countries year by year, Ethel Turner Stoneman is to be applauded for the writing of her small book, "Halfway to the Hereafter".[1] The small manual of 96 pages is an interesting inquiry into the motivation of attempted cases of, and unsuccessful efforts at, suicide. We read in detail of the sad lot of a poor man afflicted with paraphrenia, of a patient with involutional melancholia, of a feeble-minded boy who inflicted an ugly gash upon his own arm after hearing the voice of an angry God. So the book continues—tragedy after tragedy—until we feel grateful in that we are in some respects mentally normal.

Whoever conjured up the title of Miss Stoneman's book is deserving of praise. "Halfway to the Hereafter" is a label which any best-selling novelist might envy. But why will specialists surround and obscure themselves and their work with a jargon peculiarly their own, not to be understood by the ordinary practitioner? Listen to this, dealing with the paraphrenic mentioned above: "Imagery, both verbal and visual, was vivid. In the Binet-Simon tests he passed all up to the 14-year level except the 10-year design and the 10-year 60 words test. He earned half credit at year 14, one-third credit at year 16, and passed one test, the vocabulary test, at year 18. In the test of controlled motor ability he gave only a moderate performance. In the Jung association test there were thirty failures on reproduction [which, by the way, should surprise nobody], eight instances of especially long reaction time, and three mishearings. In the likes and fears test he recorded very few [and who can blame him?], being well below the first quartile in both lists."

Any general practitioner who understands the foregoing sentences may consider himself a mental dignitary. In these days there is an urgent need for a plain text book on psychology, written for the medical man in the street.

[1] "Halfway to the Hereafter: An Enquiry into the Motivation of Attempted Suicide", by E. T. Stoneman, B.A., A.M., Ph.D.; 1935. Perth: T. F. Christie, Limited; Sydney: Angus and Robertson. Demy 8vo., pp. 96.

DIFFERENTIAL DIAGNOSIS.

WE reviewed the ninth edition of Dr. Cabot's "Physical Diagnosis" in March, 1928, and the tenth in May, 1931, and shall therefore give only short notice to the English issue of the eleventh edition.[1]

The book is beautifully printed, the illustrations are profuse and very handsome, and, though Dr. Cabot is a foreigner, his English is excellent. His opinions are his own, based on his personal experience without regard to authority, and so, as he himself says, sometimes heretical. This is refreshing for the experienced physician, but may be very dangerous for beginners. An attempt, not always successful, has been made to bring the work up to date; the article on cancer of the lung is still scant, and one on pulmonary embolism compares very unfavourably with that of Samuel West, published in 1909. The preface tells us that the section on subacute infectious endocarditis has been rewritten so as to include the newer data on this important subject, and yet the text extends to but little more than half a page. As before, the use of the laryngoscope, ophthalmoscope and other special instruments, which the author does not himself employ, are omitted. A standard English text book on physical diagnosis, though much less expensive than this, covers the ground more fully.

TALMUDIC MEDICINE.

IN "A Short History of Talmudic Medicine" Dr. J. Snowman makes the modest claim of presenting a brief sketch of the subject.[2] In its ninety pages of text the ground covered is fairly wide, comprising the causation, course and treatment of diseases. There are special chapters on such subjects as gynæcology and obstetrics, leprosy and skin diseases, and others.

The Talmud consists of the Mishnah with the Gemara. The former, a compendium of Jewish civil and religious law, was compiled in Palestine. The Gemara is a collection of commentaries on its contents, and in bulk is much greater than the Mishnah. The period is that from A.D. 200 to A.D. 600 approximately. According to the general consensus of belief among medical historians, this was not a period of progress in medicine. On the social and economic sides it is somewhat arresting to learn that certain statements in the Talmud suggest that a form of insurance for medical attention was in vogue, that contract payment was in force, and that practitioners demanded their fees in advance. Surgeons and ophthalmologists will please note that if a patient died as a result of being bled, or if he lost his eye as a result of an operation for cataract extraction, the code of Hammurabi demanded the amputation of the hand of the operator.

[1] "Physical Diagnosis", by R. C. Cabot, M.D.; Eleventh Edition; 1934. London: Baillière, Tindall and Cox. Royal 8vo., pp. 564, with illustrations. Price: 22s. 6d. net.

[2] "A Short History of Talmudic Medicine", by J. Snowman, M.D., M.R.C.P.; 1935. London: John Bale, Sons and Danielsson, Limited. Crown 8vo., pp. 94. Price: 3s. 6d. net.

The Medical Journal of Australia

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All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: Initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

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GAD-FLIES.

NOT long ago an enterprising author published a pamphlet that he called "Disease, Gad-Fly of the Mind". The title was arresting and made one reflect that the term gad-fly might be applied in many directions. One of the definitions of "gad-fly" in the "Concise Oxford Dictionary" is "an irritating or worrying person". Medicine has its gad-flies. To attempt a classification of them would be an interesting entomological exercise. The author of such a classification could discuss the habitat of the species, its differentiation from other species, its characteristic manifestations and so on.

One of the chief characteristics of the medical gad-fly is a sense of his own importance, more noticeable because as a rule he is of no real importance. This is most pronounced in the surgical gad-fly. Many of our gad-flies are like the chameleon—they change their colour to suit their environment. The change may be sudden and complete; it may be frequent. To appreciate this change of colour one must know that gad-flies are jealous little creatures. The medical gad-fly is most upset if someone else, particularly of his own day and generation, achieves fame or is granted an honour. The upset is all the greater if the fame or honour is really deserved. The favourite haunt of our gad-fly is the limelight. The stronger the light, the more active is he likely to become. Some members of the species are content to receive the gaze of the members of their own profession; others prefer to bask in the fierce light of publicity.

The medico-political gad-fly is the commonest member of the species. He likes others to do the work; he would like to have credit for himself. He is slow to recognize the difficulties of the duties that he and others have imposed on the willing worker—or perhaps we should say that he ignores them. It appears as though he loved to be a source of irritation—he is a gad-fly from choice and not because he was born one. As a committee member he has few, if any, constructive suggestions to offer, but he poses as a driving force. When anything is accomplished, it is in spite of him and not because of his presence. If such a person is to be cured of his gad-fly instincts, if the effort to effect a cure is thought worth while, he should be given a great deal of work to do; he may possibly emerge from the ordeal a changed person.

The surgical gad-fly has been mentioned. He likes to be regarded as an original worker, as one with a creative mind. Our gad-flies here are of two kinds. The first is one of those who pretend to accept another's teaching and to adopt his procedures, but he never really makes the effort to become thoroughly acquainted with them, and so brings them into disrepute. The second gad-fly is concerned with gadgets. He uses another's instrument, but he adds an extra screw or he makes a flange wider or a curve a little more acute, and labels the result: "X's modification of Y's implement." For this species of gad-fly there appears to be no cure.

There are other medical gad-flies. There is the literary gad-fly, who delights in collecting an enormous bibliography and in quoting references, half of which he has never read—an irritating and unreliable person. There is the verbose gad-fly of medical discussions who must at all costs take part and whose only contribution is either irrelevant or a reiteration of what someone else has

said. But why prolong the list? Writing about these people may and probably will have no eliminating effect, but they should know that their peculiar qualities are recognized and that they are accepted by most onlookers at their true worth.

Current Comment.

AMŒBIC DYSENTERY.

INTESTINAL amœbiasis still presents some unsolved problems. How one human being contracts the disease from another is not always clear. No animal carriers are definitely known, but certain investigations suggest that rats, themselves unaffected, may act as carriers. Organs other than the intestine may be implicated. Amœbiasis of the seminal tract and urinary passages has been recorded. Cystitis may occur, and renal calculus has been erroneously diagnosed. Iridocyclitis is very rare, but dermal infection is sometimes seen about the site of evacuation of an hepatic abscess and elsewhere. Diagnosis of amœbic dysentery is not always easy, and macrophage endothelial cells in bacillary dysentery have been mistaken for amœbæ. Differentiation of the cysts of *Entamœba histolytica* from those of non-pathogenic species is often singularly difficult. Harmless forms are frequently found in man in temperate zones. Amœbic dysentery has been considered a disease of tropical and subtropical regions, but it is being found with increasing frequency in temperate and colder climates, particularly where overcrowding occurs. Dysentery raged in the Franco-Prussian War of 1870, but it is not clear that it was amœbic in origin. A considerable percentage of apparently healthy *Entamœba histolytica* cyst-carriers has been found in Great Britain in people who had never been out of that country. Asylum dysentery due to the same organism has been recorded. At Leningrad, in Russia, 22·75% of 400 food employees showed *Entamœba histolytica* infection. Amœbic dysentery is not uncommon in the northern United States of America and in Canada, and the incidence is increasing. These observations are of interest to the southern parts of Australia, for there is now no doubt that *Entamœba histolytica* may be pathogenic in temperate climates. Treatment, especially of the cyst-carrier, is not always satisfactory. Emetine and various organic arsenicals are the most suitable drugs. But emetine has definite perils of its own, including amblyopia like that of tobacco or lead. The visual defect may be a central scotoma or contraction of the visual fields. Kurchi bark of India has an excellent reputation and deserves far wider investigation. Conessine is the active principle. It is useless in amœbic hepatitis.

J. C. Paterson has made a valuable contribution on the diagnosis and treatment of intestinal amœbiasis.[1] He points out that C. F. Craig in 1932 estimated that from 5% to 10% of the inhabitants of the United States of America were infected with *Entamœba histolytica*. In 1933 an acute outbreak of amœbic dysentery occurred in the United States of America and Canada. Paterson emphasizes that intestinal amœbiasis is not peculiar to hot climates. It is prevalent in Columbia, where his observations were taken. He observes that intestinal amœbiasis may be divided into three main types: acute amœbic dysentery, chronic amœbiasis and the *Entamœba histolytica* carrier state. C. Dobell and F. W. O'Connor have stated that the ordinary person infected by *Entamœba histolytica* passes cysts in his stools. But active forms of the amœba are in the tissues of the gut wall, and precystic amœbæ in the intestinal contents. Diarrhœa may occur, and in the stools are found precystic forms and cysts in all stages of development. Dysentery may arise and blood and mucus escape from the ulcerated areas with amœbæ from the damaged tissues. Amœbæ in the stools are large active forms, often with ingested red corpuscles. Cysts and precystic forms are absent from the stools of typical acute dysentery. Red cell-containing amœbæ are not found in the stools of patients with chronic amœbiasis. Acute amœbic dysentery may be diagnosed by identifying the *Entamœba histolytica* in a fresh stool smear. The essential factor is the presence of an amœba exhibiting active movements at body temperature and containing ingested red corpuscles. Active amœbæ from stools which have cooled to room temperature are usually not histolytica. Paterson makes the rather sweeping assertion that acute diarrhœa in a patient residing where amœbiasis is epidemic offers presumptive evidence of histolytica infection. The patient's symptoms and the appearance of the stool are valuable aids in diagnosis, and the therapeutic test by emetine is especially useful in obscure cases of amœbic hepatitis when amœbæ cannot be demonstrated. If the temperature and leucocytosis are lowered after emetine administration the trouble is usually amœbic. Emetine rarely effects a cure; but it relieves acute symptoms and saves life. The only certain method of diagnosis of chronic amœbiasis is detection of *Entamœba histolytica* in the stools or scrapings obtained at sigmoidoscopy. Fresh stool smears, iodine smears or hæmatoxylin-stained smears are each of value in identifying cysts, but the hæmatoxylin-stained smear is the only satisfactory method of identifying precysts and motile amœbæ which do not contain red corpuscles. In fresh stool smears histolytica cysts can be identified in 90% of the cases. Diagnosis rests on the presence of typical chromatoid bodies. These are highly refractile cylindrical bars with blunt ends. Their presence differentiates cystic forms of histolytica from the cysts of non-pathogenic amœbæ and also from *Blastocystis hominis*, oil and air bubbles and food particles. But the bodies are not present in all histolytica cysts. In such cases an

[1] *The Canadian Medical Association Journal*, April, 1935.

iodine-stained preparation demonstrates the characteristic two pairs of small eccentric nuclei.

If doubt still exists, a hæmatoxylin-stained smear will reveal the chromatoid bodies, the nuclear arrangement and also the minute details of nuclear structure. Histolytica cyst-passers may have no symptoms, but are not necessarily free from pathological lesions. Some ulceration of the intestinal mucosa is always present and fatal results may ensue from hæmorrhage or perforation of the bowel. Liver abscess or hepatitis may also arise. In cyst-passers there is always danger to the host and to the community, especially if the patient be a food handler.

Paterson critically examines the recognized amœbicidal drugs—emetine hydrochloride, emetine bismuth iodide, bismuth subnitrate in massive doses, "Yatren" and "Stovarsol". Kurchi bark, however, is not mentioned. Paterson's contribution is noteworthy, but curiously no mention is made of C. F. Craig's complement deviation test in diagnosis.

THE MECHANISM OF CAVITY FORMATION IN THE LUNG.

PHYSICIANS interested in diseases of the lungs have long been aware that the advent of radiology has altered and added to the older pathological concepts of cavity formation. Cavities are known to appear often very suddenly, to disappear and even to move their apparent location during the course of a tuberculous infection of the lungs. These cavities are round in contour and often present strikingly little evidence of an inflammatory reaction in the immediately surrounding lung tissue; on this account the X ray shadows of some of these have been called "pleural rings", but the presence of fluid levels has proved that most of the round clear areas seen in the skiagram are truly cavities. Various hypotheses have been framed to explain these phenomena, such as inflation from a valvular bronchial opening or relaxation of the inflamed tissues.

Some simple yet ingenious experimental work has been done by S. E. Moolten on the mechanism involved in the production of these round cavities.[1] Moolten used isolated human or calf lungs and caused mechanical injury of the bronchi and adjacent lung tissue by a bronchoscopic punch forceps introduced through a bronchoscope. The injuries thus produced were found to be of the nature of elongated tears when simple laceration was practised, and irregular excavations where tissue was actually removed. Inflation of the lungs was brought about by a special negative pressure device, thus imitating the normal physiological act of respiration. This manœuvre almost invariably produced round cavities in the damaged lung. Where the bronchial wall was lacerated an appearance comparable with bronchiectasis was found, but where tissue had been punched out, balloon-like cavities were formed. These could be seen on a fluorescent screen, and their position was indicated on a skiagram by a thin annular shadow. When the lung was allowed to deflate, the cavity did not disappear entirely, however, unless the lung was deflated by suction to the point of producing definite shrinkage. In a few cases no degree of deflation or suction could alter the size of the cavity; in these cases cross-section revealed that the cavity was situated within a septum of the lung and was sealed off from the bronchial system by what appeared to be a valvular flap. These interstitial cavities were perfectly spherical, and some were as large as billiard balls. Thus it will be seen that Moolten was able to produce cavities that strongly resembled bronchiectatic cavities, spherical cavities with thin walls, emphysematous bullæ and cysts of the lung. One interesting point is that the bronchial communication with the cavities was not always valvular; it could be demonstrated as being definitely wide and flaring in some cases, occasionally more than one bronchus opening into the cavity.

Although too much stress cannot be laid on such experimental work, it would appear that a defect in the lung tissue, combined with a surrounding softening, such as occurs, for example, in pulmonary tuberculosis, might readily give rise to the formation of a spherical cavity, since the pull would be equal in all directions quite independently of the nature and degree of communication of a bronchus with the weakened zone. The ring that bounds the annular shadow seen in the X ray film may perhaps be due either to infiltration of the lung or atelectasis; in some cases at least, as observed in the lungs in tuberculosis, the latter seems likely. One further important comment is made by the author. He points out that, as the natural inflation of the lung will cause a yielding of the diseased area greater than of the healthy part of the lung, a cavity will tend to persist so long as the lung continues to be inflated. Therefore pneumothorax therapy may not control cavitation until effective collapse takes place. The physician practising collapse therapy knows in addition, however, that the presence of adhesions often prevents the complete control of the lung, and these, unfortunately, are often in immediate relation to cavities. Moolten ends his paper by claiming that the method by which diverse forms of cavitation in the lung are produced is essentially the same in all cases, and in the main, at least from the mechanical point of view, this appears to be true.

[1] *Archives of Pathology*, June, 1935.

THE PRINTING OF THE JOURNAL.

THE Manager of THE MEDICAL JOURNAL OF AUSTRALIA wishes to explain to readers that, owing to circumstances beyond the control of the Australasian Medical Publishing Company, Limited, it has been necessary for the past few weeks to print the journal on a paper different from that previously used. It is anticipated that at the end of October shipments of the original paper will arrive from Great Britain.

Abstracts from Current Medical Literature.

PÆDIATRICS.

Blood Transfusion in Malnutrition of Infancy.

MAGNUS L. THOMSON (*Archives of Disease in Childhood*, April, 1935) reports the effects of blood transfusion in twenty marasmic infants. There were three groups, the first containing six infants with malnutrition, complicated by severe enteritis, blood transfusion being performed as an emergency measure. Five of the infants died, but the sixth made a dramatic recovery. In the second group the malnutrition was complicated either by an enteritis of less severity or by other conditions, such as acute bronchitis. The seven children all made satisfactory subsequent progress. In the third group the malnutrition remained uncomplicated and an immediate and sustained gain in weight occurred in all seven infants; they had previously failed to respond to routine treatment over a long period, and no addition to the treatment was made either following the transfusion or for some days prior to it. Citrated blood was used and given by means of a syringe and cannula into an exposed vein. On an average ten to fifteen cubic centimetres of blood per pound of body weight were given. The author suggests that the transfusion may act: (i) by supplying physiological fluid, (ii) by supplying a deficiency of one or more of the solid contents of the blood, and (iii) by exciting a tissue response in the bone marrow or elsewhere.

Early Diagnosis of Tuberculosis in Infancy and Childhood.

BRANFORD MORGAN (*Journal of State Medicine*, June, 1935) discusses the problems of early diagnosis in tuberculosis in children. He considers them under five headings—clinical, radiological, bacteriological, tuberculin reactions, and blood examinations. He points out that today we are perhaps inclined to put aside too readily the suggestion that tuberculosis may be the cause of the child's ill-health; it should be always suspected in the absence of other causes. The importance of careful inquiry into contact with open cases of tuberculosis from all possible sources is stressed. The symptoms of the toxæmic state associated with tuberculosis do not materially differ from those liable to occur in the more common infections of childhood. In an infant an unexplained loss of weight is a suggestive symptom. Hæmoptysis is a very rare occurrence of intrathoracic tuberculosis in childhood. Physical examination is of little or no help. Cough may be absent in many cases of intrathoracic tuberculosis; the similarity to asthma in some cases is stressed, and the author advises radiological examination of all children with asthma as a routine procedure. The differential diagnosis of chronic cough associated with possible pulmonary tuberculosis and that following other pulmonary infections, such as pertussis and measles, is discussed; in this respect reference is made to the advice of Franz Hamburgher: "Think of tuberculosis in every case in which no other diagnosis can be made." The value of radiological examinations is not so great in childhood as in the adult, with the exception of the acute miliary type, epituberculosis, and the rare instance of the child with the adult type of the disease. The author discusses the radiological features under three headings: (i) Primary lung focus (Ghon), which, if present, is, of course, valuable evidence of infection. (ii) Tracheo-bronchial glands; calcium infiltration is the sole distinctive radiographic indication of the site of the lymph gland situated within the limits of the mediastinum. (iii) Epituberculosis, a benign consolidation of the lung involving the whole or part of a lobe, usually the right upper lobe; this is probably an allergic phenomenon, and the consolidation completely clears up within a few months. The author emphasizes the value of repeated examinations of the stools for tubercle bacilli in young children. In regard to tuberculin tests, it is generally recognized that the Mantoux test is the most reliable and that it is a valuable help in diagnosis. Failure to react to a test excludes tuberculosis, except in grave acute conditions, such as miliary tuberculosis and acute pneumonia, and in measles, whooping cough, enteric fever and influenza. A positive result to a test takes its place as a piece of evidence, but must not be allowed *per se* to establish a diagnosis. The author has had no experience of blood examinations, but states that the red cell sedimentation test appears to have many adherents regarding its value in gauging the activity of the tuberculous process.

Gastric Secretion in Cœliac Disease.

THE major disturbance in cœliac disease occurs in the alimentary tract; nevertheless very little, if any, pronounced change is found *post mortem* in the wall of the stomach or bowel, and no abnormality of the digestive juices in the small intestine has been recorded. There appears, however, to be some interference with normal function in the stomach. Jessie W. Ogilvie (*Archives of Disease in Childhood*, April, 1935) examined the gastric secretion of ten girls and seven boys with cœliac disease and compared the results with a group of healthy children. The free hydrochloric acid, total acids and peptic activity were determined. As a result of the investigations it was found that there was impaired secretion of free hydrochloric acid in the stomach, but true achlorhydria did not occur. There was no diminution in peptic activity, and the emptying time was slightly prolonged. As the patient's general health improved, an increase in the free hydrochloric acid was noted. The hypochlorhydria is probably an important ætiological factor in the production of hypochromic anæmia in patients with cœliac disease.

Gold in the Treatment of Disease.

J. EPSTEIN (*Archives of Pediatrics*, April, 1935) writes enthusiastically of the value of gold therapy in a large number of patients suffering from pertussis. A comparative study of a special group of sixty children with pertussis was made. They were divided into two groups of thirty each; to one group gold tribromide was given exclusively; to the other group a number of the usual drugs for pertussis were administered and pertussis vaccine was also given to sixteen children. The results were definitely better in the gold-treated series. As the result of a study of many patients over a period of years the author concludes that gold tribromide is superior in its therapeutic effect to any other drug used for pertussis. It has been used with good effect also in spasmodic cough due to any irritation along the respiratory tract, for example, chronic bronchitis, bronchial asthma, and in the spasmodic cough of pulmonary tuberculosis. Gold tribromide has the additional advantage that it is given by mouth. When taken into the body it dissociates into gold ions, which are antibacterial, and tribromine ions, which are neuro-sedative and antispasmodic. The author prescribes gold tribromide in a uniform, stable, assayed and palatable preparation known as elixir gold tribromide (elixir bromaurate). The dose is a teaspoonful three or four times a day after meals. It is inadvisable to add any other medicine directly to the elixir.

The Use of the Sedimentation Test and the Schilling Hæmogram.

ALEXANDER T. MARTIN AND SAMUEL L. ELLENBERG (*Archives of Pediatrics*, May, 1935) discuss the value of the sedimentation test and of the Schilling hæmogram in some pædiatric conditions. They consider that, despite doubts cast on the value of either of these tests as a guide to the status of a chronic disease process, the weight of opinion is in favour of the use of both as diagnostic and prognostic measures in the field of pædiatrics. They point out that, although the sedimentation test and the Schilling count have been performed in a great number of cases and in a wide variety of conditions, there is a paucity in the literature of reports in which both these tests were done simultaneously. They accordingly report their results of both

tests in a series of patients with various clinical conditions, for example, pulmonary tuberculosis, pneumonia, rheumatic fever and cervical adenitis. An analysis of their results indicates that there is a degree of parallelism between the two tests and that, although both tests confirm the fact that an infection is present, the Schilling hæmogram reflects the status of the disease more accurately than the sedimentation test. The simultaneous application of both tests gives more information and affords a better appreciation of the subsidence of a pathological process than does the use of either test alone.

ORTHOPÆDIC SURGERY.

Construction of an Acetabulum in Congenital Dislocation of the Hip.

A. B. GILL (*The Journal of Bone and Joint Surgery*, January, 1935) states that he always attempts bloodless reduction of congenital dislocation of the hip by gentle manipulation in children under five years of age unless the joints are abnormally rigid or unless the skiagrams show too much obliteration of the acetabulum. He believes that if a femur will not remain in the acetabulum after being four months in plaster, the probabilities are that it will not do so even after ten to twelve months in plaster. However, after 1928 he began to employ casts with turnbuckles and has found this method frequently to be very effective in drawing the head of the femur downward to the region of the original acetabulum. He gives a *résumé* of the types of dislocation, with the operation appropriate for each. The capsule is not opened at operation in Type I, in which the head of the femur is in the acetabulum or can be placed there, but the acetabulum is too shallow to hold the head securely, which results in recurring dislocation in children and subluxation of the hip in adults, and is unstable and painful. A bone shelf is turned down above the head and forward from behind. The end-results show that in all cases the hips are stable and painless. In none has redislocation occurred. In Type II, in which the head cannot be replaced in the acetabulum without opening the capsule, reduction is obtained, the capsule is closed by sutures, a bone shelf is formed, and the roof of the acetabulum is reflected downward. The end-results show that motion has always been satisfactory and sufficient for all ordinary functions of the hip. All the hips have remained stable and painless. In Type III, in which the dislocated head lies higher and cannot be brought down quite to the site of the original socket, the socket must be enlarged upward from 0·6 centimetre (one-quarter of an inch) to 2·5 centimetres (one inch) until the head slips in easily and the soft structures are not under undue tension. The end-results show that stability has been perfect in all cases. Functional results have been good. In Type IV the head lies very high and cannot be dragged downward anywhere near the site of the original socket. A new acetabulum is formed several inches above the primary one. The end-results show that in some cases there are only from 20° to 30° of motion, and in a few cases it has approached 90°. In most operations of this type he considers the surgeon may feel sure of obtaining from 30° to 45°. In Type V the neck of the femur is absent or so short that the head cannot be placed in the old or in a newly formed acetabulum. In these cases the neck must be lengthened by a transposition of the great trochanter downwards on the shaft. The end-results show that in this type of hip there may result severe loss of mobility for a time, owing to the extensive scar tissue formation in the soft tissue of the hip joint, but considerable improvement occurs as time passes. In Type VI the congenital dislocation is complicated by infantile paralysis, and he considers that an arthrodesis is the operation of choice in these cases. He states that he has never been obliged to do a rotation osteotomy of the femur or to pay any attention to anteversion beyond a few months after operation. It is his opinion that the version of the neck is corrected by physiological processes after normal function has been established in the hip joint, and that, if open reduction is necessary, in any case it is better to construct the shelf and reflect the roof at once. It requires but little more time and gives a better guarantee of a stable hip.

Non-Union in Fracture of the Shaft of the Humerus.

J. W. SEVER (*Journal of the American Medical Association*, February 2, 1935) reports five cases of non-union in fracture of the shaft of the humerus and discusses the factors making for union in this condition. He believes that there is some intrinsic cause for non-union of fractures of the humerus that is not freely understood, such as the destructive effect of the initial trauma, interference with blood supply from the damage to the nutrient artery, lack of adequate fixation, lack of callus formation, and interposition of tissues. Lack of callus formation may be due to abnormal blood chemistry or endocrine disturbance; but neither of these factors operated in his cases. He quotes Kolodny's view that if the periosteal blood supply is adequate, normal union in fracture should take place regardless of the endosteal blood supply. The periosteum is believed by all investigators to be the chief source of osteogenic cells, and he considers that repair can be obtained more rapidly by the use of osteoperiosteal graft rather than by an autogenous bone graft. In contradiction to this view, Gallie and Robertson and Moore and Corbett believe that periosteum is not an essential for the production of new bone, but that its importance depends on its control as a limiting membrane and a protection to the graft while circulation is being established from the living bone. The author believes that the differences of opinion in regard to the value of the periosteum are due to the fact that all observers consider the periosteum, with its layer of cortical osteogenic cells, as an entity, and others speak of the periosteum without this layer. In his opinion the only operation worth performing is that of the well-known on-lay graft followed by a sufficiently long period of fixation to insure union and avoid the possibility of fracture of the graft.

Intracapsular Fracture of the Hip.

L. G. HOWARD AND K. CHRISTOPHE (*The Journal of the American Medical Association*, December 15, 1934) discuss the results of one hundred consecutive intracapsular fractures of the neck of the femur treated at the Massachusetts Memorial Hospital without operation. The average period of immobilization was from ten to twelve weeks. Nineteen deaths occurred, of which fourteen were due to pulmonary and cardiac causes, two to diabetes, one to carcinoma and two to cerebral causes. Seventy-one patients were treated by the Whitman method with fifteen deaths, and twenty-eight by traction, with three deaths. In one untreated case death occurred. The location and type of fracture determined the end result to a large extent, regardless of the selection of treatment. In subcapital fracture of the neck results were good, but in central fractures they were poor. The greatest number of cases of non-union and deaths occurred in fractures of the central portion of the femoral neck, and these two terminations increased rapidly when the fracture was comminuted. A transverse simple fracture in a plane at right angles to the column of the neck generally united whether or not the location was subcapital or in the central portion of the neck. Non-union in some cases was caused by imperfect apposition of fragments, largely due to insufficient internal rotation. Inadequate immobilization was also responsible for non-union, and at least three or four cases of non-union resulted from selection of the Whitman technique in the presence of marked arthritic changes, such cases resulting in ankylosis after long immobilization and refracture of the neck after adduction was permitted. They could detect no cases of non-union which could be attributed to faulty metabolism or changes in blood chemistry. The authors stress the value of the lateral radiograph in studying the degree of rotation of the shaft.

British Medical Association News.

SCIENTIFIC.

A MEETING OF THE NEW SOUTH WALES BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Royal Prince Alfred Hospital, Sydney, on May 23, 1935. The meeting took the form of a series of demonstrations by members of the honorary staff. Parts of the report of this meeting were published in the issues of August 10 and August 17, 1935.

Intestinal Obstruction after Appendicectomy.

DR. JOHN STOREY showed a girl, aged eight years, who had been admitted to hospital under the care of a physician on January 1, 1935, during Dr. Storey's absence on holidays. The child had complained of pain on micturition for the previous fortnight. She had become worse that morning and had complained of abdominal pain. There had been rigidity and tenderness in the lower part of the abdomen, *herpes labialis*, and an appearance of illness. The temperature had been 39·4° C. (103° F.). Numerous investigations had been carried out. A surgeon had seen her on January 8 and had diagnosed "subsiding pelvic peritonitis with residual appendicitis". Dr. Storey saw the patient on January 28, when the child was well. She was discharged from hospital that day.

On March 15, 1935, she was readmitted to hospital. The mother stated that the child had not been well and had had vague pain, off and on, in the right side, and had not been eating well. Her bowels had been opened with medicine. On March 18 a kinked appendix was removed by operation. Owing to adhesions considerable trouble was experienced in performing the operation. The convalescence was troublesome and a little vomiting occurred each day till March 28 when the signs of obstruction became insistent. Stercoraceous vomiting was present for two or three days, and in spite of this the patient's condition remained good. It appeared that Nature had provided for the elimination of waste products by the wrong end of the alimentary canal. Gastric lavage was practised. A mid-line incision was made on March 28. Loops of small intestine were found bound down to the pelvic brim with collapsed small intestine beyond and distended coils above. Several coils were tapped with a trocar and cannula attached to the suction apparatus. The holes were closed with purse strings of fine silk. An attempt was made to free the attached bowel, with the result that the peritoneal coat was stripped. This coat was sewn back and a side-to-side anastomosis was made between a distended loop and a collapsed loop of ileum, two layers of sutures being used—fine silk for the peritoneum and fine chromicized catgut for muscle and mucous membrane together.

An intravenous injection of 10% glucose in normal saline solution was given in the theatre. The child made an excellent recovery and was transferred to a convalescent home on April 29. At the time of the meeting there was nothing to see, except a healthy-looking little girl with surgical "trade marks" on her abdomen.

Dr. Storey said that he had told the members of the Branch at Newcastle that "it took a team of horses to make him reopen the abdomen", but the team had arrived at a hand gallop just after his return to Sydney.

Fracture Dislocation of the Ankle.

Dr. Storey also demonstrated a fracture dislocation of the ankle. An account of this case will be published in full in a subsequent issue.

Toxic Goitre.

DR. H. R. G. POATE showed four patients who had been operated on for toxic goitre. The patients were all married women, aged 53, 44, 45 and 43 years respectively. The clinical histories of the patients were outlined in detail. Operation in three instances was carried out under gas and oxygen, and in the remaining instance under ethylene anæsthesia. In every instance the patient's condition had improved after operation.

Aneurysm of the Aorta.

DR. J. H. HALLIDAY reported the history of a male patient, aged fifty-four years, who died suddenly in April, 1935. In January, 1930, the patient complained of tearing pain in the chest; the pain had been present for three months and was accompanied by breathlessness on exertion. Examination revealed an enormous aneurysm of the ascending aorta, extending almost out to the lateral thoracic wall. Between 1930 and 1935 the patient had had continuous intense antisyphilitic treatment, including eight courses of arsenic, as well as bismuth and iodides. X ray examination in 1930 and 1935 revealed a great increase in the size of the aneurysm during this period.

Dr. Halliday showed the *post mortem* specimen of the ruptured aneurysm. Over one pound of cotton wool was required to fill the cavity before the specimen was fixed. The myocardium appeared comparatively normal, with little hypertrophy. Only one segment of the aortic valve was demonstrably thickened. Dr. Halliday said that this specimen afforded a very vivid example of the predilection of the spirochæte for the first part of the aorta.

Thyreotoxicosis.

Dr. Halliday also showed a married man, aged thirty-eight years, who had complained of increasing prominence of the left eye for the last three weeks. It was very difficult to elicit any history of ill-health. The patient had recently had a slight ache behind the left eye and pain across the forehead. He had lost 12·6 kilograms (two stone) in weight during the last twelve months.

The patient had had no previous illnesses. His father came from Mauritius, and the patient had always had an unusual colour.

On examination the patient was a thin man with marked exophthalmos of the left eye and slight widening of the right palpebral fissure. Slight diffuse enlargement of the thyreoid gland was present. No tremor was present. The pulse was regular, with a rate of 92. There was no hypertension. On April 26, 1935, the basal metabolic rate was +41%; on May 3 it was +19%.

Coronary Sclerosis with Paroxysmal Ventricular Tachycardia.

Dr. Halliday's second patient was a single man, aged fifty-eight years. He had complained of attacks of palpitation for two years, with shortness of breath on exertion.

In 1933 the patient had had to cease his work as overseer of a railway gang on account of palpitation and shortness of breath. He consulted his medical adviser, who informed him that his heart was fibrillating. Two other medical practitioners examined him and told him that he was quite all right. The fourth medical practitioner found some abnormality and advised the removal of septic tonsils. This was done and was followed by a mastoid operation (he had had discharging ears since childhood). Three months later he resumed work for a short period, but his breathlessness became more pronounced and he had not worked for the last twelve months.

When admitted to hospital the patient complained of dizziness on stooping. At times he felt his heart suddenly beat rapidly, as if the spring of a watch was suddenly released. He complained of pain in the left side of the chest at night in bed, particularly if he lay on his left side. He had noticed that the attacks of palpitation came on after a heavy meal, and once after a drink of rum. He had had no previous illnesses, except those mentioned.

On examination at the time of his admission to hospital some breathlessness on slight exertion was noted. His colour was normal. No significant changes were seen in the retinal arteries. Slight cardiac enlargement was present. The systolic blood pressure was 185 and the diastolic pressure 110 millimetres of mercury. On first examination the heart sounds were perfectly regular.

Subsequently at varying intervals a rapid succession of varying numerous beats, just palpable at the wrist, was noted. These could be provoked by effort. A teleröntgenogram revealed slight generalized enlargement of the heart. An electrocardiogram revealed a condition of paroxysmal ventricular tachycardia. The paroxysms recorded were of short duration, and the normal rhythm was shown in each lead of the tracing before and after the abnormal type.

Otitis Media.

DR. J. J. WOODBURN showed a girl who had had discharging ears since early childhood. Both ears presented the same symptoms: thick discharge from the middle ear, pain over the mastoid areas and vertigo, and both ears suffered loss of hearing.

The patient was shown because the condition of the middle ear cleared up on each side; different methods were employed. A complete radical operation was performed on the left ear with loss of hearing. A modified radical operation was done on the right ear with restoration of hearing almost to normal. Schwartze's mastoid operation had been done on each ear previously without result.

Intraperitoneal Rupture of the Bladder.

DR. RICHARD FLYNN demonstrated a patient who had suffered from intraperitoneal rupture of the bladder. This case will be reported in full at a later date.

Gunshot Wound of the Kidney.

Dr. Flynn also showed a boy who had suffered from a gunshot wound of the kidney. This case will be reported in full at a later date.

Ramisection for Constipation.

Dr. Flynn reported a case in which the operation of ramisection had been carried out for constipation. This case will be reported in full at a later date.

Colico-Vesical Fistula.

DR. B. T. EDYE showed a man, aged seventy-three years, who was suffering from a colico-vesical fistula. On the patient's admission to hospital some four weeks previously there was a history of gradually increasing constipation for two years, pains at the root of the penis during micturition for the past two months, passage of dirty malodorous and gaseous urine for six weeks, and of loss of weight for six weeks. There was no history of diarrhœa, malena or of the passage of mucus. A general examination revealed an indefinite mass, deeply situated, just above the pubes. Nothing abnormal was detected by rectal examination, and on sigmoidoscopy the instrument was held up at eight inches from the anus. Cystoscopy had to be abandoned, as the visibility was obscured by turbid urine. A barium enema had been given and a carcinoma of the sigmoid was suggested. Laparotomy revealed that the lower half of the sigmoid was involved in a hard mass firmly adherent to the sacrum, just below the promontory. The bladder was adherent to this mass. No glandular enlargement or metastatic nodules were detected and the remainder of the sigmoid appeared normal. A left inguinal colostomy had been done and within a few days the urine had become clear and the symptoms had abated. Dr. Edye explained that the weight of evidence was probably in favour of a diagnosis of carcinoma, although the good general condition of the patient and the appearance of the mass was rather more suggestive of diverticulitis. The colostomy had been done to relieve the symptoms due to the fistula, and would probably be permanent, as the mass was inoperable, and in this case there appeared to be no prospect of separating the bladder from the mass.

Mixed Tumour of the Parotid.

Dr. Edye also showed a man, aged fifty-three years, with a tumour of the left side of the neck, just behind the angle of the mandible. Some fourteen years previously Dr. Edye had removed a tumour of the left carotid body from this same patient. At that operation it had been necessary to remove portion of the common carotid artery at its bifurcation, the internal jugular vein and the vagus nerve, as these structures were invaded by the tumour. The case was reported in THE MEDICAL JOURNAL OF AUSTRALIA of December 9, 1922. Following this operation the patient had remained well until this present tumour first appeared some twelve months ago. Since then it had steadily increased in size to the present proportions of a small hen's egg. It had been quite painless, and until four months ago had not given rise to any symptoms. During these four months the patient had had an occasional fainting turn on rising in the morning and had noticed a cough with mucoid sputum. If the lower portion of the tumour was touched, a coughing attack followed. The tumour formed a smooth rounded projection filling the interval between the angle of the mandible and the anterior border of the sterno-mastoid muscle. It was fixed to the deeper structures and was moderately hard. It projected into the left lateral wall of the pharynx and into the soft palate. The nervous signs had been investigated by Dr. Bye, who considered them to be manifestations of cerebral degeneration following the disturbance of blood supply. It was explained that tumours of the carotid body rarely formed metastases, and in this instance it was considered that the tumour was probably a mixed tumour of the parotid, exhibiting a considerable degree of local malignancy. The patient was given deep X ray therapy, as his poor general condition and associated nervous signs made an extensive operation more than a justifiable risk.

Umbilical Hernia and Fibromyoma of the Uterus.

Dr. Edye's third patient was a spinster, aged forty-four years, who sought treatment for a hernia of six years' duration and was found to have not only a large umbilical hernia, some six inches in diameter, but also a huge abdominal tumour. The condition was symptomless, apart from an occasional yellowish discharge *per vaginam*, and the menstrual history was perfectly normal. The abdominal tumour was firm and lobulated and appeared to arise from the pelvic viscera, but its mobility and exact relations could not be established because the patient was stout and pelvic examination was difficult. The patient was demonstrated before operation so that members could examine the tumour. The provisional diagnosis of umbilical hernia and *fibromyomata uteri* was confirmed at operation, and the specimen was found to weigh twelve pounds.

A MEETING OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION was held at the Victorian Eye and Ear Hospital on June 19, 1935. The meeting took the form of a series of demonstrations by members of the honorary medical staff.

Modern Methods of Testing Hearing.

DR. ERIC GUTTERIDGE demonstrated modern methods of testing hearing by means of calibrated forks with the use of graphs adopted by Lowndes-Yates, of London. Cases of cochlear deafness and of mixed deafness, as in chronic catarrhal *otitis media*, were demonstrated. Dr. Gutteridge described how compensation was obtained by retraining the hearing in deafness of minor degree.

An interesting exhibit shown by Dr. Gutteridge was an audiometer, made locally by the Audicon Institute for the Deaf. This machine tests hearing by a loud-speaker and by head telephones. There is a third attachment to test the bone conduction of the patient. Dr. Gutteridge stated that by these air and bone conduction tests an accurate measurement of the patient's loss of hearing for each of the usual frequencies could be obtained. The type of deafness could be determined by a process of analysis. The frequency of the machine was kept constant. A gramophone disk was incorporated in the machine, from which a "pick-up" led to the loud-speaker and headphones, and a test of the hearing distance for conversational voice at two and at four syllables a second could be readily arranged.

Obstruction of the Eustachian Tube.

DR. NOEL BOX demonstrated how obstruction of the Eustachian tube could be diagnosed and should be treated. He said that autoinflation by Valsalva's method indicated a patent Eustachian tube. The sudden feeling of fullness would cause an involuntary complaint from the patient, who would feel the passage of air into the middle ear. Under inspection the sudden outward movement of the drum would be seen by the observer. By the use of the auscultation tube the observer could obtain auditory confirmation of the passage of air through the patient's Eustachian tube to the middle ear. Inflation with Politzer's bag would be tried if auto-inflation failed. Failure then would indicate some degree of obstruction, and a Eustachian catheter would be passed. If difficulty was experienced, a nasal endoscope could be introduced through the nostril of the opposite side to identify and illuminate the orifice of the tube, into which the catheter could be passed under inspection. Dr. Box remarked that the chances of error were greatly reduced by this method and that it was indicated in those cases in which a considerable degree of obstruction required the passage of flexible sounds into the tube through the Eustachian catheter. The Eustachian tube could be dilated throughout its membranous portion by this procedure. Septal spurs and deviations might require surgical intervention before the naso-pharynx could be entered by the nasal route.

Chronic Suppurative Otitis Media.

DR. CECIL GARDINER showed several patients suffering from chronic suppurative *otitis media* and discussed the treatment. One patient, aged seven years, had had a discharging ear for a month when first seen at the hospital. On examination a large polypus was presenting through a central perforation of the drum. It had been removed under general anæsthesia (ethyl chloride) and with ear toilet three times daily the drum had healed in five days and the hearing was not impaired.

Nasal Obstruction.

DR. CECIL CANTOR showed four patients illustrating various causes of nasal obstruction.

The first patient, an adult male, had almost complete occlusion of the right nasal airway, due to gross septal deviation of the developmental type. The left nasal cavity was unduly patent. The middle turbinal was hypertrophic and polypoid and extended across to the deflected septum. The mucosa of this side of the nose was dry, with crusting and early atrophic changes. Dr. Cantor demonstrated the pathological state of the left nasal cavity as a good example of the results of over-aeration and excessive patency, and expressed the opinion that submucous resection of the deflected cartilage would give complete restoration of function and of appearance.

The next patient, an adult male, had a septal obstruction of the traumatic type. The original injury had fractured the nasal bones and the septal cartilage. The latter had been fractured in several places and had united in an irregular manner, blocking the right side of the nose. Dr. Cantor said that operation in these cases was far more difficult than in those of the developmental type, owing to the dense adhesions which formed between the muco-perichondrium and the cartilage, making elevation of the former impossible at times.

Another patient, also an adult male, had right nasal obstruction due to polypi. Right suppurative *otitis media* was also present. Masses of polypi filled the nasal cavity and were sequelæ of polypoid ethmoiditis. A skiagram showed that the right maxillary antrum was dull. It was filled with polypoid mucosa. The ethmoidal labyrinth was dull and the cell outlines were obscured. Pus was obtained as a result of antral lavage. Dr. Cantor considered that localized removal of the polypi would give relief only for a few months and then they would recur. He said that the operation which gave the best results in this type of case was the Jansen-Horgen. This consisted of the radical antrum operation, with a complete ethmoidectomy, the approach to the ethmoids being via the postero-superior internal angle of the maxillary antrum.

Dr. Cantor's fourth patient, an adult male, had an extensive gumma of the pharynx. The ulcer involved the posterior pharyngeal wall from above the level of the soft palate down to the valleculæ. This had been present for twelve months, despite extensive therapy. A recent blood specimen had given a very strong Wassermann reaction.

The Technique of Antral Lavage.

Dr. Cantor also demonstrated and described the technique of antral lavage. He said that this procedure was carried out under local anæsthesia for adults and for children over five years of age. The use of general anæsthesia was restricted to very young children or to those who were refractory. Antral lavage should be painless. No pain was caused if sufficient anæsthesia of the antro-nasal wall was obtained and the operator understood the technique.

Dr. Cantor used a solution of 10% cocaine with adrenaline, applied by means of a fine cotton wool carrier with a small pledget firmly attached. This was placed in the inferior meatus against the antro-nasal wall for ten minutes. Puncture was made with a sharp Lichwitz trocar and cannula. Dr. Cantor said that force was not needed. If resistance was encountered that seemed to require force, the trocar was too far anterior or posterior, in which directions the bone was thicker. The correct position was about half way along the meatus, high up, and near the turbinal attachment. The point should be directed towards the outer canthus of the eye to safeguard against penetrating the orbital plate. The lavage was performed by means of a Higginson syringe attached to the cannula. Dr. Cantor emphasized the fact that antral lavage was undoubtedly the most valuable therapeutic measure available in the treatment of acute, subacute and many chronic antral infections.

Nasal and Aural Tumours.

DR. MARK ASHKENASY showed some patients with interesting nasal and aural tumours. One was an elderly woman who had attended at the hospital originally on account of discharge from the ear associated with intermittent severe pain within and behind the ear. She was admitted to the ward for observation. It was found that she had a cardiac lesion and also moderately severe diabetes. The painful discharging ear cleared up while she was undergoing treatment for diabetes. A small aural polypus could be seen and was demonstrated by Dr. Ashkenasy.

The second patient shown by Dr. Ashkenasy was a man, aged sixty-seven years, who had excessive salivation due to enlargement of the submaxillary glands and the presence in the soft palate of a mixed salivary tumour.

The other patients of Dr. Ashkenasy were young girls. One had a large mulberry type swelling of the right inferior turbinate, and the other had a small dermoid on the tip of the nose.

Cosmetic Nasal Operations.

DR. FRANK DONOVAN showed three cases of nasal plastic surgery in different stages of operation. One patient had a congenital nasal abnormality. The next had a combined congenital and traumatic abnormality, and the third abnormality was purely traumatic. The first demonstrated Frühwald's method of straightening the nasal bones and making them narrower. In the second patient the completed operation could be seen. After the nasal bones had been straightened and the nose had been narrowed the bump had been removed. Then the shape of the nose had been restored by a hinged cartilage graft obtained from rib cartilage. In the case of the third man the nasal bones had been narrowed by means of external incisions preparatory to the use of a cartilage graft to restore the shape of the nose.

Discharging Ears.

DR. THOMAS G. MILLAR discussed discharging ears and drew attention to the fairly common condition of silent mastoiditis. After surveying the normal course of cases

of acute and subacute *otitis media* and the routine treatment of discharging ears, Dr. Millar stated that he preferred dry sterile swabbing of the external auditory canal to syringing and instillation of drops. It was very important to prevent the stagnation of discharge in the canal. In the second week insufflations of iodized powder were of great therapeutic value. Dr. Millar demonstrated the method of inserting the powder and stated that the results obtained with it were so constant that he felt almost justified in saying that a discharging ear which failed to respond to it was one for operation.

He then dealt with the problem of those ears that discharged for three or four weeks. The first important investigation was that of the site of the perforation of the ear drum. As a generalization, anterior perforations suggested some focus in the nose or throat, such as infected adenoid or suppurative antritis; posterior perforations were likely to be associated with infection of the mastoid cells.

Dr. Millar then summarized the clinical evidence of "silent" mastoiditis—mastoiditis without external swelling and tenderness. The diagnosis was suggested by pulsating discharge from a posterior perforation persisting in spite of efficient treatment, contraction of the osseous meatal wall to a funnel shape, persistent thickening and angry appearance of the tympanic membrane, persistent throbbing sensation and loss of sense of general well-being. The diagnosis could be established by radiography of the mastoid cells. Dr. Millar demonstrated the skiagrams of three examples and then discussed the operative treatment. No operation was of any value that did not aim at complete removal of every accessible mastoid cell between the two tables of the skull. Incomplete operations led only to poor healing and secondary operations. The results of complete operations were exceptionally good; invariably the offending ear was dry within a week and the patients were usually out of hospital within two weeks.

Dr. Millar concluded by recounting three examples of silent mastoiditis. The first patient was a child, aged six years, who had had measles in November, 1934, complicated by a discharging left ear. The discharge had persisted until late in January, 1935, when the condition was investigated. It was not associated with pain or with mastoid tenderness. The nose and throat were of normal appearance. There was a posterior perforation of the tympanum with a small polypus forming in it, and a small pulsating discharge could be seen coming through the perforation. The skiagram of the mastoid cells was positive. At operation chronic mastoid osteitis had been found with gross polypoid mucous membrane in the cells and free pus in the deep tip cells. The ear was dry on the third day and the patient left hospital twelve days after operation.

The second patient was a child, aged four years, who had had a discharging right ear for three weeks without pain or mastoid tenderness when the investigation was made. The nose and throat were clear. A postero-superior perforation was present with an early small polypus and pulsating discharge. The skiagram at that stage was inconclusive, but when no improvement was obtained with iodized powder for one week it was repeated and was positive. At operation there was free pus in the mastoid cells and generalized infection. The ear was dry in one week and the child left hospital on the tenth day after operation.

The third patient was an adult male, whose ear had been discharging for three weeks when the investigation was undertaken. There had been very little pain, but he had noticed a throbbing sensation and a general feeling of weakness. On examination the nose and throat were normal, but there was profuse discharge from an antero-inferior perforation of the drum, which was red. The skiagram was positive. At operation there was free pus in the mastoid cells, perisinus abscess was present and granulations had formed on the sinus wall. The ear was dry in seven days and the patient left hospital on the fourteenth day after operation.

Acute Nasal Sinusitis.

DR. HUGH MITCHELL delivered a short lecture on acute nasal sinusitis. He started by outlining the anatomy of the sinuses, pointing out that they were merely outgrowths from the nose lined by the same ciliated columnar epithelium. Necessarily they became infected with every cold, influenzal attack or acute infection of the nasopharynx. In fact each of these infections was a pansinusitis which usually cleared up in a week or two. If an attack lasted longer than this, the patient would say that the cold was hanging on or that he had catarrh.

The commonest symptom was nasal obstruction, intermittent in type and alternating from one side to the other with postural drainage. The temperature might rise to 37·8° or 38·3° C. (100° or 101° F.). There was usually a discharge of yellow or greenish-yellow pus, either from the front or from the back of the nose, and, contrary to the general belief, there was very little pain. Pain occurred mainly with blocking of an ostium. Headaches were by no means constant, but, when present, were generally worse in the morning. More usually the feeling was a heaviness or fullness in the frontal region. It was but seldom that there were any other symptoms.

The signs also might be very slight and indefinite. Frequently the patients looked sallow. The temperature might be somewhat elevated in the afternoon and down again at night. Dr. Mitchell described how, on one occasion, he wakened feeling as well as usual and went to work, but by 2 p.m. his temperature had risen to 38·3° C. (101° F.). He felt very ill and went to bed. This afternoon malaise recurred daily for a week. During this period he had three wash-outs and the sinusitis cleared up.

Examination of the nose usually revealed reddened swollen turbinates, often with strings of sticky muco-pus between the turbinates and the septum, and nothing else. Occasionally yellow pus would be seen streaming down over the inferior turbinate. This would have come from the ostium under the middle turbinate. The appearance of this pus was of diagnostic importance, but more frequently the sinuses had emptied before the nose was inspected, or the ostium might be blocked with swollen mucosa. If no pus had been seen in the nose, recourse must then be had to transillumination and/or radiography. Dr. Mitchell stated that transillumination was of little value unless one side was dark and the other bright. His records had proved to him that, even with both sides clear there might still be trouble, and both sides might be dark simply because of the presence of thickened bone. Radiography was of real assistance. He exhibited some interesting films and emphasized the advantages to be gained with the film vertical and the rays horizontal. The chief advantage was the way in which a fluid level showed up except when the antrum was full. He demonstrated normal films, films of acute sinusitis showing fluid levels and swollen mucosa, and second films of some of the patients taken after an interval of some six weeks which showed conclusively that it was a simple matter to obtain cures if treatment could be commenced in the acute or subacute stage.

Dr. Mitchell explained that the anterior sinuses all emptied through the *hiatus semilunaris*. The upper sinuses had outlets from the bottom, but the antra emptied from the top. On account of paralysis of the cilia and the position of the outlet, the antrum was unable to empty itself and the overflow pus kept the hiatus swollen and the other sinuses obstructed. When the antrum was washed out the hiatus settled down and the other sinuses drained themselves. Therefore the treatment of acute sinusitis, in most instances and to a great extent, became the treatment of the antra.

He explained that the nasal mucosa would not tolerate any but the mildest medicaments and that it was seldom that he used anything in the nose, except steam from inhalations. He might paint the middle turbinate with a 10% solution of cocaine and adrephine in equal proportions. He felt that while other drugs, especially those containing adrenaline, gave immediate relief, the patient was likely to be worse off an hour or so afterwards than he would otherwise have been.

If the symptoms still persisted after ten to fourteen days of expectant treatment, antral lavage under cocaine anæsthesia should be undertaken. This was painless unless an ostium was blocked. He used a 1% boracic acid lotion and repeated the lavage every second day until the return was clear. On an average, three to five wash-outs were sufficient to clear up the condition. If one had to use six or seven wash-outs without curing the patient, more radical surgery had to be considered. When the ostium was found to be blocked it was advisable to introduce a second cannula, washing in through one and out through the other. Two days later the ostium would be found to be patent again.

NOMINATIONS AND ELECTIONS.

THE undermentioned have been elected members of the New South Wales Branch of the British Medical Association:

Adam, Geoffrey Shedden, M.B., B.S., 1933 (Univ. Sydney), Newcastle Hospital, Newcastle.
Edwards, Malcolm Livingston, M.B., B.S., 1933 (Univ. Sydney), 14, Ian Street, Rose Bay.
Mowat, John Kenneth, M.B., B.S., 1935 (Univ. Sydney), Goodooga.
Price, John William Lennox, M.B., B.S., 1933 (Univ. Sydney), Base Hospital, Orange.

Correspondence.

THE HEREDITARY FACTOR IN MENTAL DISORDERS.

SIR: I was interested to read in the correspondence columns of your journal of August 3 last a commentary so obviously inspired by a true spirit of scientific inquiry on your sub-leader in the issue of June 22, dealing with the subject of mental deficiency and the hereditary factors in mental disorders. This is somewhat of a contrast when considered in relation to the not uncommon attitude of apathy and despair usually displayed for the most part by the medical profession towards the problems presented by these conditions. The subject matter referred to is certainly an involved one and beset with many pitfalls, both theoretical and practical, and it appears to me that one cannot become correctly orientated to the points raised by your correspondent unless full consideration is given to blastogenic variants *pari passu* with hereditary. The former may be conceived as a centrifugal force making for difference and instability, the latter as a centripetal force making for stability and sameness. If it is appreciated that what is transmitted or persists in hereditary is not the modification *per se*, but only the power of acquiring it under similar circumstances, then the appearance of a mental disorder after a period of so-called apparent normality will be the more readily understood—this likewise applies to constitutional factors, either physical or mental.

The term mental deficiency is after all only an abstraction and essentially is a generic name for a number of variations from the normal mental condition.

While not desiring to be drawn into a controversy respecting the relative importance of hereditary or environmental factors in the production of the neuroses or psychoses, it might be conceded that all serious students of the subject give due recognition to and accept the significance of both sets of factors. It appears that there will be little intelligent appreciation of the matter or progress eventuate until mental deficiency is no longer regarded as a minor form or variety of imbecility or idiocy, but rather as normal variation of mental endowment.

This does not make the matter any the less a social problem, and it appears to me that the "plight of the psycho-pathologist and psychiatrist" lies not in their failure to appreciate the hereditary factors or methods of approach in dealing with the problems, social and medical, of mental deficiency and mental disorders in general, but rather in their not unworthy efforts for enlightenment as to what is the biological basis of normal variations of mental endowments.

Yours, etc.,

GREY EWAN.

Mental Hospital,
Rydalmere,
New South Wales,
August 7, 1935.

SCHILDER'S DISEASE.

SIR: Following upon Dr. Holmes à Court's report upon a case of *encephalitis periaxialis diffusa* (Schilder's disease), I am forwarding my case history notes of this patient, who was attended by me for three months before being sent to Sydney. The case presents features of ophthalmological interest.

On December 1, 1933, R.S., aged seven years, was sent to me by Dr. I. H. Sender. There was a history of failing vision for the previous six weeks. On allowing the child to wander about the room, he collided with objects in the manner of one whose visual fields are contracted.

On examination, vision in each eye and binocularly was $^{6}/_{\infty}$. Both pupils reacted normally to light and accommodation. Ophthalmoscopic examination revealed a fine pigmentation, similar in appearence to very early pigmentary degeneration of the retina or to the retinal pigmentation sometimes seen in syphilis. The optic disks were normal.

At this time the patient did not exhibit the apathy which later became such a marked feature.

X ray examination of the skull and a blood Wassermann test were recommended and the following differential diagnosis was suggested: (1) *Retinitis pigmentosa* (pigmentary degeneration of the retina), (2) maculo-cerebral family degeneration, (3) syphilis, (4) intracranial tumour.

A fortnight later I again examined the child, but could find no change in his condition. The Wassermann test and X ray examination of the skull both failed to reveal any abnormality. He was subsequently admitted to Kurri hospital for observation, and during his stay there developed mental apathy and physical indolence. Also he became completely blind, although the pupils continued to react normally. I was most surprised to read in the report in THE MEDICAL JOURNAL OF AUSTRALIA that vision was $^{6}/_{\infty}$ as I saw him about twenty times and was convinced that there was no perception of light.

Eventually he was sent to Sydney for investigation by a physician. I must admit that the correct diagnosis did not occur to me.

The extraordinary feature of this case to an oculist is failure of vision with normal pupillary reactions. This excludes any lesion of the optic nerves, optic chiasma, optic tracts and ocular centres in the mid-brain; on the other hand, it suggests a bilateral lesion of the optic radiations or the occipital cortex, surely an extremely rare eventuality. Dr. Latham's demonstration of the involvement of the lateral ventricles and contiguous areas explains the bilateral nature of the ocular symptoms and the absence of pupillary signs.

Yours, etc.,

A. W. D'OMBRAIN,
M.B., Ch.M. (Sydney), D.O.M.S. (London),
Honorary Ophthalmic Surgeon, Maitland, Kurri Kurri and Cessnock Hospitals.

West Maitland,
New South Wales,
August 7, 1935.

WHOOPING COUGH AND VACCINE TREATMENT.

SIR: Dr. Murray objects to the small number of "controls" shown in my article on "Whooping Cough, with Special Reference to Pertussis Vaccine". To a certain extent he is right, but if Dr. Murray's knowledge of the ravages of pertussis were comparable with his "flair" for statistics, he would realize how unjustifiable it is to condemn any child to eight or nine weeks of the disease when it might be possible to limit the duration to three or four weeks.

Accordingly I could only obtain "controls" from two sources: (i) from those whose complications, on presentation, precluded the use or value of vaccine; and (ii) from those whose parents refused to allow injections.

Dr. Murray's other suggestion is sinister, and I would ask him to state clearly what he means by his remark: "He would do well in future not to allow any element other than chance to enter into his selection of controls" *et cetera*. When this question is answered I shall be in a better position to deal with what appears to be a very improper and damaging statement.

Yours, etc.,

IVAN BLAUBAUM.

Armadale,
Victoria,
August 12, 1935.

Proceedings of the Australian Medical Boards.

NEW SOUTH WALES.

THE undermentioned have been registered, pursuant to the provisions of the *Medical Act*, 1912 *and* 1915, of New South Wales, as duly qualified medical practitioners:

Mathews, Ian Hamilton Killough, M.B., B.S., 1934 (Univ. Melbourne), Wagga.
McQueen, Ewen Neill, M.B., B.S., 1935 (Univ. Sydney), 181, Liverpool Road, Ashfield.
Mowat, John Kennedy, M.B., B.S., 1935 (Univ. Sydney), Hornsby District Hospital.
Murphy, Patrick Francis, M.B., 1935 (Univ. Sydney), 5, Victoria Road, Bellevue Hill.
Van Nooten, George Henry, M.B., B.S., 1929 (Univ. Melbourne), Yarrawonga, Victoria.
Wallace, Edgar Charles Moreland, M.B., B.S., 1933 (Univ. Melbourne), Royal Alexander Hospital for Children, Sydney.
Boan, Alan Ernest, M.B., B.S., 1933 (Univ Melbourne), St. Kilda, Melbourne.
Dent, John Courtney Abbot, M.B., B.S., 1927 (Univ. Sydney), Inverell.
Kennedy, Patrick Adrian Cattanach, M.B., B.S., 1926 (Univ. Melbourne), Victoria.
McClelland, Margaret, M.B., B.S., 1921 (Univ. Melbourne), Prince Henry Hospital, Sydney.
Caselberg, Alexander Lionel, M.B., Ch.B., 1921 (Univ. New Zealand), Corrimal.
Fryberg, Abraham, M.B., B.S., 1928 (Univ. Melbourne), Mental Hospital, Callan Park, Sydney.
Sargent, Rex James, M.B., B.S., 1929 (Univ. Adelaide), Broken Hill.
Cutner, Philip Norman, M.B., Ch.B., 1931 (Edinburgh), M.R.C.S., 1933 (England), L.R.C.P., 1933 (London), F.R.C.S., 1934 (Edinburgh), England.
Christie, Joseph, M.B., B.S., 1935 (Univ. Sydney), 19, Mears Avenue, Randwick.
Hall, Maida Elsie Wilhelmina Buxton, M.B., B.S., 1935 (Univ. Sydney), c.o. T. G. Hall, 255, Macquarie Street, Sydney.
Hatcher, Frank, M.B., B.S., 1935 (Univ. Sydney), Hornsby District Hospital.
Hill, Bruce Goodwin, M.B., 1935 (Univ. Sydney), 517, Pacific Highway, Killara.
Kellet, William Hessel, M.B., B.S., 1935 (Univ. Sydney), Manly District Hospital.
Latham, John Victor, M.B., B.S., 1935 (Univ. Sydney), The Grove, Roseville.
Lee, John Russ, M.B., B.S., 1935 (Univ. Sydney), 63, Bland Street, Ashfield.
Maynard, Stanley Clive, M.B., B.S., 1935 (Univ. Sydney), 96, Victoria Street, Ashfield.
Prior, Allen Percival, M.B., B.S., 1935 (Univ. Sydney), Mental Hospital, Parramatta.
Sharp, Henry Walter Ritchie, M.B., B.S., 1935 (Univ. Sydney), 57, Vaucluse Road, Vaucluse.

University Intelligence.

THE UNIVERSITY OF SYDNEY.

A MEETING of the Senate of the University of Sydney was held on August 12, 1935.

The Busby Musical Scholarship for 1935 was awarded to Mr. L. T. Shea, a fourth-year student in the Faculty of Medicine.

It was resolved to accept with grateful thanks an offer from Mr. H. R. Kemp, B.D.S. (Superintendent of the Dental Hospital of Sydney), to provide an annual prize of £2 2s. in the Faculty of Dentistry for regional anæsthesia.

The following appointments were approved: Dr. A. A. Abbie as Senior Lecturer in Anatomy; Dr. F. W. Niesche as Acting Lecturer in Anatomy for Michaelmas Term, 1935; Dr. H. C. E. Donovan as Lecturer in Obstetrics at the Women's Hospital (Crown Street); Dr. A. J. Gibson as Demonstrator in Obstetrics at the Women's Hospital (Crown Street); Dr. J. Goodwin Hill as Tutor in Obstetrics at the Women's Hospital (Crown Street); Dr. P. D. Braddon as Tutor in Surgery at Royal Prince Alfred Hospital.

Obituary.

DONALD TREGONNING.

WE regret to announce the death of Dr. Donald Tregonning, which occurred at Claremont, Western Australia, on August 5, 1935.

SAMUEL HARDY HALAHAN.

WE regret to announce the death of Dr. Samuel Hardy Halahan, which occurred on August 14, 1935, at Cheltenham, Victoria.

GEORGE BILL.

WE regret to have to announce the death of Dr. George Bill, which occurred on August 16, 1935, at Junortoun, Victoria.

THE STAWELL MEMORIAL FUND.

THE undermentioned subscriptions have been received for the Stawell Memorial Fund:

£3 3s.: E. R. White.
£2 2s.: F. D. Jermyn, S. A. Ewing.
£1 1s.: A. H. Green, L. Bryce.

Diary for the Month.

AUG. 27.—New South Wales Branch, B.M.A.: Medical Politics Committee.
AUG. 28.—Victorian Branch, B.M.A.: Council.
AUG. 29.—South Australian Branch, B.M.A.: Branch.
AUG. 29.—New South Wales Branch, B.M.A.: Branch.

Medical Appointments.

The undermentioned have been reappointed to the Honorary Staff of the Mareeba Babies' Hospital, South Australia: Dr. G. H. B. Black (B.M.A.), Visiting Ophthalmologist; Dr. H. S. Covernton (B.M.A.), Medical Officer and Medical Officer to Nursing Staff; Dr. M. T. Cockburn (B.M.A.), Physician; Dr. F. N. Le Messurier (B.M.A.), Medical Officer; Dr. H. M. Mayo (B.M.A.), Consulting Responsible Medical Officer; Dr. A. M. Mocatta (B.M.A.), Assistant Physician; Dr. W. C. T. Upton (B.M.A.), Dermatologist.

* * *

Dr. H. K. Fry (B.M.A.) has been reappointed an official visitor to the Parkside Mental Hospital, South Australia, under the provisions of the *Mental Defectives Act*, 1913.

* * *

The undermentioned appointments have been made to the Honorary Staff of the Adelaide Hospital, South Australia: Dr. S. R. Burston (B.M.A.), Physician; Dr. H. K. Fry (B.M.A.), Physician; Dr. F. R. Hone (B.M.A.), Assistant Physician; Dr. K. S. Hetzel (B.M.A.), Assistant Physician; Dr. E. McLaughlin (B.M.A.), Assistant Physician; Dr. A. T. B. Jones (B.M.A.), Surgeon; Dr. I. A. Hamilton (B.M.A.), Assistant Surgeon; Dr. A. H. Lendon (B.M.A.), Assistant Surgeon; Dr. N. S. Gunning (B.M.A.), Clinical Assistant to the Surgical Section; Dr. G. E. Jose, Clinical Assistant to the Surgical Section; Dr. J. E. Hughes, Clinical Assistant to the Surgical Section; Dr. H. M. Rees (B.M.A.), Clinical Assistant to the Surgical Section.

* * *

The undermentioned appointments have been made to the Night Clinic Department of the Adelaide Hospital: Dr. G. E. Jose, Medical Officer (Male Section); Dr. J. M. Dwyer (B.M.A.), Second Medical Officer (Male Section); Dr. H. M. Fisher (B.M.A.), Medical Officer (Female Section).

* * *

Dr. K. H. Broome (B.M.A.) has been appointed Government Medical Officer at Coonamble, New South Wales.

Medical Appointments Vacant, etc.

For announcements of medical appointments vacant, assistants, *locum tenentes* sought, etc., see "Advertiser", pages xvi, xvii, xix.

ALFRED HOSPITAL, MELBOURNE, VICTORIA: Honorary Officers.
BLAIR ATHOL DISTRICT HOSPITAL, QUEENSLAND: Medical Officer.
BOULIA HOSPITAL, BOULIA, QUEENSLAND: Medical Officer.
DEPARTMENT OF MENTAL HYGIENE, MELBOURNE, VICTORIA: Junior Medical Officer, Temporary Medical Officer.
LAUNCESTON PUBLIC HOSPITAL, LAUNCESTON, TASMANIA: Resident Medical Officer.
NEWINGTON STATE HOSPITAL AND HOME, SYDNEY, NEW SOUTH WALES: Honorary Ophthalmic Surgeon.
REPATRIATION COMMISSION: Resident Medical Officers.
THE OTAGO HOSPITAL BOARD, OTAGO, NEW ZEALAND: Resident Medical Officer.
WESTERN SUBURBS HOSPITAL, SYDNEY, NEW SOUTH WALES: Medical Superintendent.

Medical Appointments: Important Notice.

MEDICAL practitioners are requested not to apply for any appointment referred to in the following table without having first communicated with the Honorary Secretary of the Branch named in the first column, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

BRANCH.	APPOINTMENTS.
NEW SOUTH WALES: Honorary Secretary, 135, Macquarie Street, Sydney.	Australian Natives' Association. Ashfield and District United Friendly Societies' Dispensary. Balmain United Friendly Societies' Dispensary. Friendly Society Lodges at Casino. Leichhardt and Petersham United Friendly Societies' Dispensary. Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney. North Sydney Friendly Societies' Dispensary Limited. People's Prudential Assurance Company Limited. Phœnix Mutual Provident Society.
VICTORIAN: Honorary Secretary, Medical Society Hall, East Melbourne.	All Institutes or Medical Dispensaries. Australian Prudential Association, Proprietary, Limited. Mutual National Provident Club. National Provident Association. Hospital or other appointments outside Victoria.
QUEENSLAND: Honorary Secretary, B.M.A. Building, Adelaide Street, Brisbane.	Brisbane Associate Friendly Societies' Medical Institute. Chillagoe Hospital. Members accepting LODGE appointment and those desiring to accept appointments to any COUNTRY HOSPITAL, are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.
SOUTH AUSTRALIAN: Secretary, 207, North Terrace, Adelaide.	All Lodge appointments in South Australia. All Contract Practice Appointments in South Australia.
WESTERN AUSTRALIAN: Honorary Secretary, 205, Saint George's Terrace, Perth.	All Contract Practice Appointments in Western Australia.
NEW ZEALAND (Wellington Division): Honorary Secretary, Wellington.	Friendly Society Lodges, Wellington, New Zealand.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to "The Editor", THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

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